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ABSTRACT

This book of readings consists of selected papers presented under five topics: (1) Research and Theory--18 papers including research on visual effects on attitude and cognition, students of different field dependence levels, modern and postmodern design on reader perceptions of news, effects of gray shades, short-term memory capacity differences, developing thinking citizens across cultures, microcomputers, computer-generated animation, the use of real and computer generated models, effects of color code in graphic presentation, varying visual activities to impact cognitive processing, biological concepts through animated movies, describing picture content, nurturing creativity, and logical reasoning; (2) Curriculum Approaches--13 papers including topics on visual literacy and writing; picture book production; creative drama; geography; business, scientific, and art students; and the use of films in teacher education; (3) Text and Graphic Design--six papers including lexi-visual design, evolution of publishing technology, pixels, sign dictionary graphics, learner characteristics and instructional strategies, and deaf adult literacy; (4) Media and Technology--10 papers concerning medical education, visually impaired students, perceptual factors in television, training videotapes, television production, virtual reality and visual design; and (5) The Arts--nine papers on contemporary art, visual literacy and the technological age, use of color and motif, African American screen images, the Johnstown Flood, early Japanese photographs, image manipulation, a deaf poet's view, and questioning the verbal supremacy of traditional literary studies. (ALF)

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VISUAL COMMUNICATIONS:

Bridging Across Cultures

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Judy Clark-Baca
Darrell G. Beauchamp
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VISUAL COMMUNICATION: BRIDGING ACROSS CULTURES

Selected Readings from the
23 rd Annual Conference of the
International Visual Literacy Association

Edited by

Judy Clark Baca
Darrell G. Beauchamp
Roberts A. Braden

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Referee Procedure

This book of readings consists of selected papers presented at the 23rd Annual Conference of the International Visual Literacy Association held in October, 1991 in Washington, D.C. The selection process for inclusion in this book of readings was as follows:

1. Proposals submitted in response to a call for papers were referred to a committee who screened them and either accepted them for presentation or rejected them based upon criteria for presentation at the conference;
2. Each of the selected presenters were invited to submit a paper for evaluation by the editors who decided which papers would appear in the book of readings. This decision was made based upon the clarity, timeliness, and appropriateness of the topic presented;
3. Each paper accepted was edited and returned to the authors for revision;
4. Final, camera-ready copy was returned to the editors and published in this book of selected readings.

Members of the 1991 presentation/paper screening committee:

Ronald Nomeland
Jane Norman
Ronald Sutton
David Martin

Members of the 1991 conference executive planning committee:

Fatemah Olia
David Martin
Ronald Nomeland

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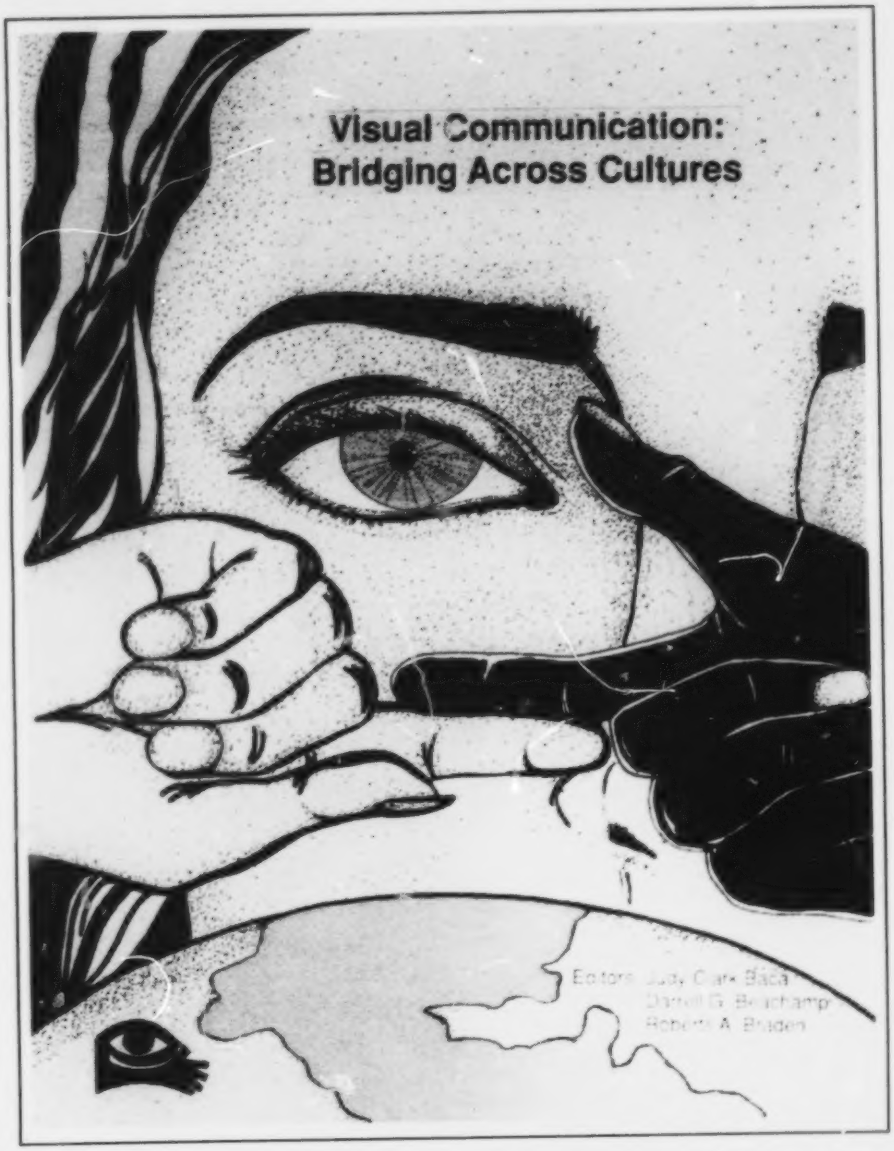
About the Cover

The cover was designed by **Christian Burke**, a first year graphic design student at California State University, Chico. Christian's introductory graphics class was given a book cover project as its first design assignment. Forty-odd student visual concepts were submitted. The course instructor, **Dr. Greg Berryman**, assisted the editors of this book in choosing the twenty-two strongest designs. Those renderings were placed on display at the Annual IVLA conference at Washington, D.C. The conference attendees served as a mass jury, voting Christian's design as the winner of the cover competition for this annual IVLA Book of Readings.

After Mr. Burke's design was chosen, he transposed his artwork, which was in "comp" form into the final printer's mechanical. The actual printing of the cover was done on a student press in the graphic arts laboratory at CSU, Chico, with the assistance of **Dr. Richard "Rick" Hannemann**. *[Rick is a member of IVLA and a contributor to this volume.]*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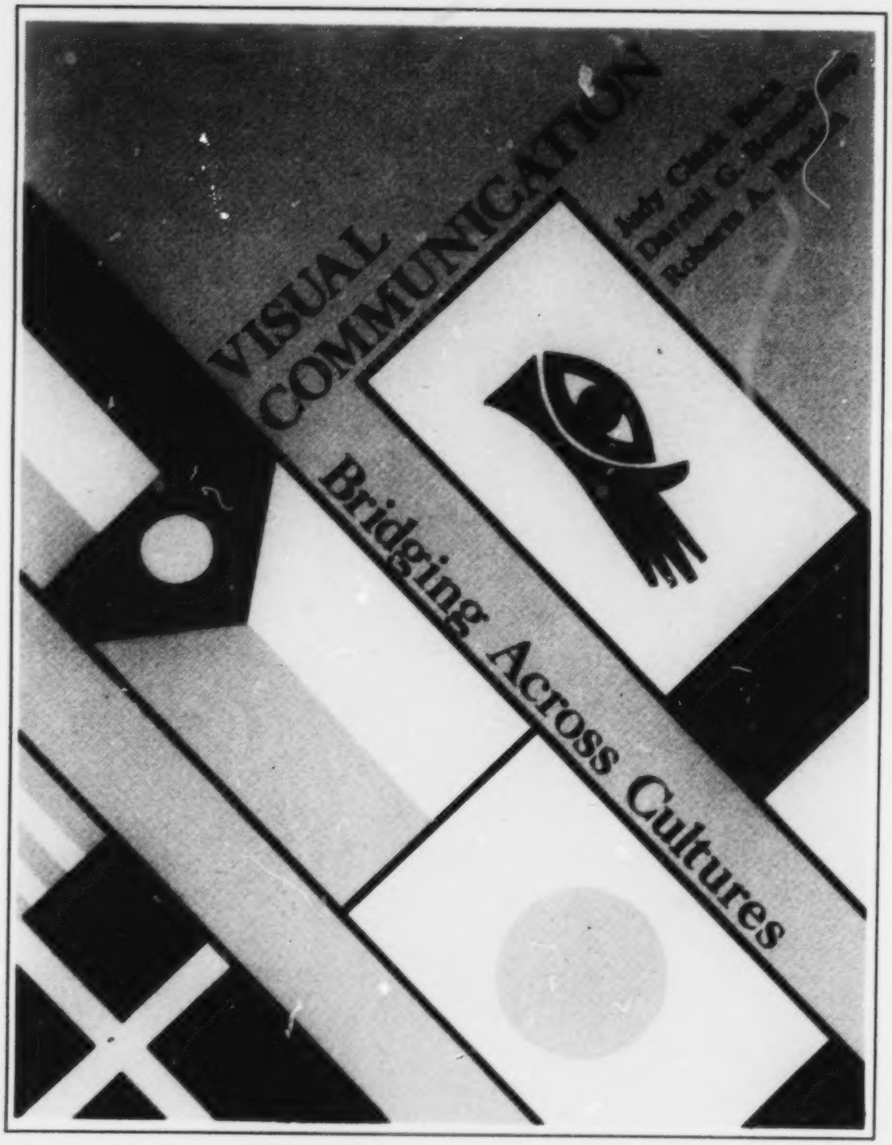
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RESEARCH
and
THEORY

Visual Effects in Video Production and Their Effect on Attitude and Cognition

William J. Gibbs
Robert E. Griffin

Review of Literature

A great deal of literature has been accumulated which measure the treatment and situation variables in television. Ellery[1] designed an experiment which tested a variety of production techniques. Several video productions were made of the same content matter using these production techniques. The televised lectures were watched by high school students and in none of the comparisons were there any significant differences found resulting from the production techniques. Cobin and McIntyre[2] show similar results in their study of college level students. Chu and Schramm[3] brought these and other research studies to the attention of other researchers in their highly regarded publication, **Learning from Television: What the Research Says**. They concluded that "there is no clear evidence on the kind of variations and production techniques that significantly contribute to learning from instructional television".

Background

Penn State's Smeal College of Business Administration in 1973 began producing a career video series for undergraduate business students. The intended purpose of the series is to provide students with business career information and to assist them in choosing a major. Each video in the collection depicts an interview between a college academic counselor and a representative from a business or corporation.

The production of the career series is structured so that a minimal amount of production time is required. Productions can be scheduled on short notice and completed relatively quickly. Such flexibility serves two purposes. First, it helps accommodate the schedules of visiting business representatives who are to be interviewed in the series. Second, it makes assessable to students the most current career information available.

Over the past several years, as the series has evolved, video production methods have been refined. Currently, small production teams manage studio set up, camera operation, direction and post production work. With the refinement of production techniques a greater emphasis is now placed on post production editing and the utilization of special video effects. As a result, the time and cost to produce each video has increased. Whether these increases produce significant benefits to students has yet to be determined.

Purpose of Study

The purpose of the study is to investigate whether increases in the production value of a career information video resulting from video editing and special effects are substantiated by their effect on students' cognition and attitude.

Methodology

The sample population consisted of Penn State undergraduate students who were enrolled in a variety of majors. A total of sixty-six subjects participated in the research study. Subjects were randomly assigned to one of three treatment groups in which they viewed a seventeen minute video interview between a college counselor and a business representative. The interview content pertained to business logistics career information. All treatments received the same informational content but were differentiated by the amount of editing and special effects incorporated in the video. A description of each of the three treatments follows:

Treatment One:

The video tape used in this treatment was not edited and incorporated no special effects. A single stationary camera was used to record the career interview.

Treatment Two:

The video presented two camera angles and incorporated reaction shot editing and talent name titles. No other video effects were used.

Treatment Three:

The video presented two camera angles, incorporated reaction shot editing, talent name titles, word visuals, and beginning and ending credits.

The distribution of subjects across treatments is depicted in Figure 1.

Figure 1
Distribution of Subjects

Treatment	Subjects
1	18
2	24
3	24
Total	66

After watching the video, subjects were given a 21 item multiple choice test to measure their learning. This assessment instrument tested subjects' understanding of the essential information conveyed in the career video. Additionally, a 13 item attitude survey was administered to collect subjects' reactions to the career video.

The cost of production for each of the three treatments video tapes was determined by calculating the labor and equipment cost, as well as the cost for using the production facilities. The following is a sampling of the assigned charges for labor, equipment and facilities:

- Labor charge = $6.00 per hour for each production assistant.
- Equipment charge = $2.00 per hour for each studio camera and $0.50 per hour for each lavaliere microphone.
- Facility charge = $8.00 per hour.

Results

Production Costs

During the course of the project we maintained a careful record of the cost of producing each treatment. This is not to say that we kept a budgetary cap on each treatment, rather we allowed each treatment to take its normal course and we created programs as would normally have been done in our laboratory. Costs varied between the treatments depending on the amount and type of production and post production equipment used and the amount of labor devoted to the project. The same director and editor were assigned to all three treatments to ensure that they received the same editorial treatment.

Costs of the treatments are shown in Figure 2.

Figure 2
Cost of Treatment

Treatment	Total Cost of Production
1	$ 46.50
2	$119.50
3	$214.50

Cognitive Measure

The study set out to measure two elements. First, we wanted to take a cognitive measure and see what the students learned from the program. Students were given a 21 question multiple choice exam. This instrument was devised to test for information the researchers felt was relevant career information. Results from the cognitive measure are shown in Figure 3.

Figure 3
Cognitive Measure

Treatment	Mean Score
1	16.56
2	16.71
3	14.83

There is no difference in what the student learned from any of the treatments. The appearance of a difference between Treatment 3 and Treatments 1 and 2 is not significant.

Affective Measure

To be sure that we made an adequate measure of whether or not people liked the video programs, we made several tests. A 13 question, (five point Likert type) affective measure was administered to all subjects that viewed the video tape. It was intended to measure the viewers attitudes toward three areas; production values of the program, attitude toward the interviewer and general attitude toward the program. The three measures were simply called production, talent and general. A value was assigned to all student responses and a mean score calculated. The results are shown in Figure 4.

Figure 4
Affective Measure
(Mean Score)

Treatment	Production	Talent	General
1	3.3	4.2	3.7
2	3.3	3.9	3.4
3	3.2	3.9	3.4

As with the cognitive measure, subjects did not appear to favor one treatment over another. There is no significant difference between the measures or their treatments.

Significance of the Results

There are several significant results that can be derived from this study. First, cost of production and time spent in post production does not have a bearing on the training value of the program. The video in this study having the least exotic production was judged comparable to the two treatments production which were more complicated. In fact, the cost of producing Treatment 3 is about 4 times greater than the cost of producing Treatment 1. Less expensive productions appear to be as good as their more heavily produced counterparts.

Two addition non statistical measures require further investigation. While we have reported that there is no statistical significance in the data reported, there appears to be some minor differences. First, there is an interesting difference in the mean scores in the cognitive treatments. Why did the mean score for the cognitive measure for Treatment 3 go down to 14.83? Because of the additional video attributes most instructional designers would assume that the cognitive results would have increased. One can now only assume that the added instructional variables distracted the subjects from learning from the program.

Another non statistical question appears in the affective measure of the talent. While many of the subjects were critical of the interviewer in the production, the difference is less pronounced in Treatment 1 than in Treatments 2 and 3. We speculate that this difference is due to the close-ups used in Treatments 2 and 3. These close-ups probably direct undue attention by the subjects on the interviewer. Without the close-ups subjects appear to like the interviewer more.

This study has added to our understanding of video production. As producers of training programs we must be careful to add only those elements which add to the production and be careful not to add effects that detract. We must better understand the instructional value of the tools in our production repertoire.

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2. Cobin, M.T. and McIntyre, C.J., ***The Development and Application of a New Method to Test the Relative Effectiveness of a Specific Visual Production Technique in Instructional Television.*** USOE Projection #448 Urbana, University of Illinois, 1961

3. Chu, Goodwin, C. and Schramm, Wilbur, ***Learning from Television: What the Research Says***, National Association of Educational Broadcasters, Washington, D.C., 1979

Effect of Color Coding on Visually and Verbally Oriented Tests with Students of Different Field Dependence Levels

Francis M. Dwyer
David M. Moore

A considerable amount of research has dealt with the identification of individual differences among learners and how best to approach these differences in developing learning strategies and supporting materials has led to active experimentation and inquiry concerning the role of cognitive-style variables. The usefulness of cognitive style research depends on its potential to identify specific information processing differences between several types of students. Field dependence-independence has been examined more closely than other cognitive styles, no doubt because it describes characteristics which are so directly applicable to the learning process. Measures of field dependence such as the GEFT employed in this study are arguably tests of ability. In fact, the aspect of field dependence-independence that is tapped by the GEFT has been identified as cognitive restructuring ability. There is certainly a strong visual-spatial element in field dependence-independence (Wilkin, 1977). For this reason researchers have attempted to design visual instruction according to the characteristics of field-dependent and independent learners, hoping to capitalize on strengths and compensate for weaknesses.

Witkin, et. al. (1977) and his associates have noted that certain individuals interact to superfluous cues in a visualized instructional environment while others are able to identify precisely the critical information contained in a complex visualized environment. These two orientations called field dependence (FD) and field independence (FI) represent two ends of a continuum. Field dependent individuals, when presented a visualized presentation tend not to modify the structure but accept and interact with it as it is presented. They tend to fuse all segments within the visual field and do not view or interact with the visual components discretely. Field independents tend to act upon a visual stimulus, analyzing it when it is organized and providing their own structure when it lacks organization.

The FD/FI cognitive style appears to be especially important in the design of visually related information. Although many studies have examined the effects of visual attributes on learning (Dwyer, 1978, 1987) few have studied the effects of varied visual attributes on specific cognitive learning styles. Research has shown that color coding helps learners organize or categorize information into useful patterns which enables the learners to interpret and adjust to their environment. Color coding may be considered a strategy which students enhance or sharpen essential message characteristics by providing structures for the storage of new information (Dwyer, 1978). Dwyer (1978), in an extensive review of research on the impact of color vs. black and white comparison, found "color versions were to be significantly more effective than the black and white versions in facilitating student achievement of specific educational objectives. These results seem to provide substantial evidence that colors, in fact, are a viable instructional variable" (p. 149). However, a qualification is noted in that color has to be used judiciously and the visuals need to be appropriate for the type of educational objective to be achieved.

It was hypothesized that color coded visuals (Color) would be more effective than black and white coded visuals (B&W) in enhancing the salient visual cues thereby making them more identifiable and instructional to field dependent learners. The color coding would attempt to compensate for the restructuring skills absent in field dependent learners and subsequently lead to deeper information processing and increased achievement. This hypothesis seems plausible since field dependent learners tend to be global in perception and would be most inclined to take advantage of the increased structure provided by the color coding.

However, do color enhanced diagrams also have any effect on retention on verbal tests? Previous studies have investigated the use of B&W and Color coded illustrations to support use of color enhancement over black and white illustrations in answering questions of a verbal nature, i.e., terminology and comprehension (Dwyer, 1967, 1978, 1987). However, there is no research available which investigates the role of color on verbal style questions across the cognitive style known as field dependence (FD), field independence (FI). Additionally, it is not known whether coding (B&W and Color) and field dependence interact or whether color coding positively affects the deficiency of field dependent learners to organize and structure instructional content.

Specifically, the purpose of this study was to examine the effect that coding (B&W and Color) has on the achievement of students categorized as FD/FI learners and to determine if there was any interaction between these variables (field dependency and color) across both visual and verbal oriented tests measuring different educational objectives, namely to learn terminology and basic facts, to identify locations and/or positions, construct and/or understand relationships and to engage in problem solving activities. It was anticipated that the findings of the present study would provide teachers and designers of instructional software with techniques and aids to be used with students possessing different cognitive styles.

Procedures

One hundred nineteen students enrolled in a basic educational psychology course at The Pennsylvania State University participated in this study. Students were classified as field dependent, field neutral, or field independent as a result of their performance on the Group Embedded Figures Test (GEFT), (Wilkin, et al, 1971). Students were divided into the different levels based on their mean achievement level on the GEFT. The grand mean achievement by students on the GEFT was 13.08 with a standard deviation of 4.01. Students with one half standard deviation above the mean were considered to be field independent (n = 43, x =17.0, SD = .81); students located one half a standard deviation below were classified as field dependent (n = 29, x = 7.33, SD = .81). Students in the middle were classified as neutral FN (n = 45, x =13.17, SD = 1.49) (Moore & Dwyer, 1991). Students in the three GEFT levels were randomly assigned to two treatment groups. The subject content for the study consisted of a 2,000 word instructional booklet on the anatomy and functions of the human heart. Each booklet contains 19 illustrations which were designed to illustrate the content being presented verbally. The illustrations in Treatment I, the black and white version, contained black and white coded line drawings which highlighted the information and processes being presented. Students in Treatment II received the same visuals as did students in Treatment I; however, several different colors were used to highlight the information and processes being discussed. The major independent variables in the study were the effect that B&W and Color coding of information had on the information processing strategies of students identified as possessing different levels of field dependence.

Dependent Measures

Each student, after interacting with their respective instructional treatments, received two visually oriented criterion tests. The drawing test required students to draw a representative diagram of the heart and place the number of listed parts (n=20) in their respective positions. The emphasis for this test was on the correct positioning of the verbal symbols with respect to one another and in respect to their concrete referents. The identification, a 20-item multiple choice test, required students to identify the numbered parts on a detailed drawing of a heart. The objective of this test was to measure the ability of the student to use visual cues to discriminate one structure of the heart from another and to associate specific parts of the heart with their proper names. K-R 21 reliability coefficients from the drawing and identification tests were .67 and .80 respectively.

Each student, after interacting with their respective instructional treatments, also received two verbally oriented criterion tests. The terminology test (K-R 21, .83) was a twenty-item multiple choice test which evaluated students' knowledge of facts and terminology and the comprehension test (K-R 21, .88) measured understanding of the internal processes occurring within the heart during the diastolic and systolic phases (Moore & Dwyer, 1991).

Results

A series of two-way analyses of variance were used to analyze the data. The independent variables of color enhancement and cognitive style were tested across each of the four dependent measures (drawing, identification terminology and comprehension tests). An analysis of variance conducted on the drawing test indicated that there was a significant difference in mean achievement for cognitive style (FD/FI), F (2, 111) = 3.99, p < .05.

Field independent students (x =16.42) scored significantly higher on the drawing test than did field dependent students (x = 12.93) on both the B&W and Color coded treatments. Across all levels of cognitive style (field dependent, field neutral, field independent), students who received the color coded illustrations (x = 17.35) achieved significantly higher scores on the drawing tests than did students who received the B&W coded illustrations (x = 12.24). See Table 1 for mean scores.

On the identification test, field independent students (x = 17.23) achieved significantly higher than did field dependent students (x = 14.41), F (2,111) = 4.51,p < .05. No significant differences in achievement were found to exist on the identification test between students receiving the B&W and Color coded instructional treatments, F (1, 111) = 3.83, p. > .05. Although across all levels of cognitive style, the mean achievement scores of students on the identification who had received the Color coded treatment (x = 16.76) were significantly higher than those who received the (B&W) coded treatment (x = 15.09). See Table 2 for mean scores. When student scores across the drawing and identification tests were combined into a total test both cognitive style mean score (FD/FI), F (2, 111), = 5.00, p. < .05, and Color coding, F (2, 111) = 24.48, p. < .05 were significant.

On the terminology test field independent students (x = 14.54) scored significantly higher in achievement than field dependent students (x = 11.24), F (2, 111) = 5.37, p. < .05. In examining the differences across cognitive style levels, no significant differences in achievement were found on the terminology test between students receiving the B&W and Color coded treatments, F (1, 111) = .65, p. > .05 (Moore & Dwyer, 1991). An insignificant interaction was found to exist between cognitive style and color coding (B&W and Color), F (2, 111) = .29, p. < .05. See Table 3 for mean scores.

An analysis of student achievement on the comprehension test indicated that field independent students (x = 12.81) scored significantly higher than field dependent students (x = 10.66), F (1, 111) = 3.81, p. < .05. However, no significant differences in achievement were found to exist on the comprehension test between students receiving the B&W and Color coded treatments (Moore & Dwyer, 1991). See Table 4 for mean scores.

On the total criterion test in which all four dependent measures were combined, a significant difference was found to exist among the three field dependence levels, F

Table 1 - Mean Scores - Drawing Test

Field Dependence		Color		Total
		Color	Black & White	
FI	Mean	17.8	14.50	16.42
	SD	2.57	3.45	3.36
	n	25	18	43
Neutral	Mean	16.96	11.68	14.38
	SD	2.76	3.86	4.24
	n	23	22	45
FD	Mean	17.10	10.74	12.93
	SD	3.28	5.46	5.66
	n	10	19	29
Total	Mean	17.35	12.24	14.77
	SD	2.75	4.54	4.54
	n	58	59	117

Table 2 - Mean Scores - Identification Test

Field Dependence		Color		Total
		Color	Black & White	
FI	Mean	17.32	17.11	17.23
	SD	2.87	2.22	2.59
	n	25	18	43
Neutral	Mean	16.70	14.50	15.62
	SD	3.61	3.64	3.75
	n	23	22	45
FD	Mean	15.50	13.84	14.41
	SD	3.75	4.99	4.60
	n	10	19	29
Total	Mean	16.56	15.09	15.92
	SD	3.34	3.98	3.76
	n	58	59	117

Table 3 - Mean Scores - Terminology Test

Field Dependence		Color		Total
		Color	Black & White	
FI	Mean	14.48	14.61	14.54
	SD	4.33	3.68	4.03
	n	25	18	43
Neutral	Mean	13.22	12.05	12.64
	SD	3.78	4.08	3.92
	n	23	22	45
FD	Mean	11.80	10.95	11.24
	SD	4.42	4.06	4.13
	n	10	19	29
Total	Mean	13.52	12.48	12.99
	SD	4.18	4.16	4.18
	n	58	59	117

Table 4 - Mean Scores - Comprehension Test

Field Dependence		Color		Total
		Color	Black & White	
FI	Mean	12.28	13.56	12.81
	SD	3.78	4.54	4.11
	n	25	18	43
Neutral	Mean	12.83	8.68	10.80
	SD	3.64	3.81	4.24
	n	23	22	45
FD	Mean	10.70	10.63	10.66
	SD	5.29	4.18	4.50
	n	10	19	29
Total	Mean	12.22	10.80	11.50
	SD	4.01	4.56	4.34
	n	58	59	117

$(2, 111) = 6.29, p. < .05$, and significant differences were found to exist between the B&W and Color coded treatments, $F (1, 111) = 10.62, p. < .05$. No significant interaction was found to exist between treatment type and the three field dependence levels, $F (2, 111) = 2.06, p. > .05$.

Two secondary analyses were conducted to examine achievement differences occurring among the three field dependence levels when students received only the B&W or Color coded treatments. The one way ANOVA indicated that significant differences existed in favor of the field independence students on all tests; the drawing test, $F (2, 58) = 3.78, p. < .05$, the identification test, $F (2, 58) = 3.83, p. > .05$, the terminology, $F (2, 56) = 4.19, p. < .05$, and comprehension tests, $F (2, 56) = 6.81, p. < .05$, when they received the B&W coded instructional treatments; however, when making the similar comparison among students receiving only the Color coded treatments no significant differences were found to exist among FD/FI students on the four independent criterion measures [drawing test, $F (2, 57) = .60, p. > .05$; identification, $F (2, 57) = 1.07, p. > .05$, the terminology test, $F (2, 57) = 1.60, p. > .05$, and the comprehension test, $F (2, 57) = .98, p. > .05$].

Discussion

The results of the experimental study support that the contention that field independent and field dependent learners differ in the cognitive processes they use as well as in the effectiveness of these cognitive processes as measured on tests measuring different education objectives. In the present study, field-independent students scored significantly higher than did field dependent students on the drawing, identification, terminology and comprehension tests (Table 1-4). These results might have been expected since prior research (Moore & Bedient, 1986) have found that field independent learners tend to score higher on criterion measures which require the acquisition of information from visualized instruction and are used to assessing visually complemented instruction. This finding is also consistent with the previous reviews of the literature that have concluded that field independent learners exhibit an active, hypothesis-testing strategy towards learning, whereas field dependent learners tend to employ a more tentative or spectator approach to learning (Goodenough, 1976; Witkin, 1971). Annis (1979), in a study investigating cognitive style on study technique, found that field dependent students did not score as well as field independent students in completing items of high structural importance even when the passage was well organized. The implication being that field dependent students, in addition to receiving a well organized passage, may need explicit structural support to insure that they identify and interact with the critical aspects of the information being presented.

In the present study, significant differences in achievement were found to exist between FD/FI learners on the drawing test. Apparently, the use of color coding of the visualization did not provide sufficient structuring of the critical information to alter the information processing level of field dependent learners on this learning task which required students to construct and/or position the parts of the heart in their appropriate context on the drawing. However, on the identification test no significant differences in achievement were found between FD/FI learners who had received the Color coded treatments. For the type of learning measured by the identification test, Color coding was instrumental in providing the level of learning structure which enabled the FD learners to achieve at a level similar to that achieved by the FI learners. Prior research supports the notion that field dependent learners benefit from the restructuring aspect of instructional strategies (i.e., B&W coding to Color coding), while FI learners are not impeded by imposed structures (Greene & Davis, 1971; Slatterly & Telfer, 1979).

As noted previously, students identified as field independent in this study also achieved significantly higher scores on the two verbally oriented criterion tests than did students identified as field dependents. It appears the field independent learners were able to identify the essential salient cues and impose a more meaningful structure on the perceptual field in relation to the content being presented. Field dependent learners interacted with identical visualized content; however, they only interacted with the visualized instruction (perceptual field) at a superficial level. An inspection of the means achieved on the terminology (Table 3) and comprehension tests (Table 4) by students in the different FD/FI levels indicated that just over 50 percent of the total content to be measured by each criterion test was acquired as a result of the visual coding (B&W and Color) of the instructional content (Moore & Dwyer, 1991).

In analyzing the performance of students who received only B&W coded treatments, it was found that the field independent students achieved significantly greater scores than did the field dependent students on the four criterion tests: drawing, identification, terminology and comprehension. The single color coding strategy (B&W) was not sufficiently strong enough to alter the information processing strategies of the field dependence learners. However, it was expected that the Color coded visuals would make the relevant cues more obvious to the field dependent learners, thereby improving their achievement on the verbal tests. The insignificant results on all four criterion tests did support this contention. Apparently, the Color coded illustrations provided a sufficient structure for the field dependent learners to interact with and internalize at a level similar to that achieved by the field independents. Field independent learners who interacted with the color Coded illustrations may have felt that these illustrations adequately conveyed the intended information and did not utilize their special skills to process the information deeply. For example, the directions to the instructional unit indicated that the unit was designed to help them understand the functions of the human heart. Students, as they preceded through both instructional treatments, may have felt that they understood the content adequately. Performance on the criterion tests between the two groups might have changed significantly if the directions in the instructional booklet had indicated that they would not only have to understand the functions of the human heart but would also have to perform on a test measuring knowledge of terminology and the functions of the various parts of the heart during the diastolic and systolic phases. Possibly, specific directions relating to precise performance expectations would have stimulated the field independent learners to use their special skills to initiate deeper information processing which, in turn, would have led to increased information acquisition.

The results of this study indicate that the concept of field dependence/field independence is an important instructional variable in the teaching-learning process. Color coding was also found to be an effective instructional variable for maximizing the information processing acquisition level for field dependent learners on the types of criterion measures employing visually oriented tests used in this study. The significant interaction on the comprehension test between treatment and cognitive style (FD/FI) found in this study appears to be a spurious finding and needs to be replicated before credibility can be attached to its existence. However, on verbally oriented tests, color coding was not found to be an effective instructional variable for maximizing the information processing acquisition levels across all levels of field dependence.

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Effects of Modern & Postmodern Design Styles on Reader Perceptions of News

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USA Today *design is postmodern, unlike the traditional and modern styles identified by previous research. This study had subjects read a murder news story or a weather feature and measured their indirect response to four variables simulating postmodern and modern styles. The study found that readers perceived the two articles differently, as expected. Design style did not have the same effect as layout direction alone. Readers perceived time-period differences in the content of stories read in different design styles. The postmodern style was considered less formal and beautiful and also older. The results support the theory that the form of news changes the perception of its content.*

Research before 1982 on newspaper design (and some work published subsequently), tended to classify newspapers as either *traditional* or *modern* (Click and Stempel, 1974; Scissors, 1974). In a recent summary of the research, Pasternack and Utt (1986) described the two styles: Traditional style had narrow columns, vertical design, column rules, many stories, few (and small) pictures, and so forth. The epitome of traditional newspaper design is the *Wall Street Journal*. Modern style had wider columns, horizontal design, no column rules, fewer stories, and more pictures. The exemplary modern newspaper is harder to identify, but as good a candidate as any might be the *Washington Post*.

Since it began publishing in 1982, *USA Today* has become a bellwether of newspaper design. Other papers have begun to be classified by whether they follow the path blazed by *USA Today* or not (Didion, 1990). *USA Today* does not fit either the traditional or modern style. Although it incorporates many of the devices of traditional design — the narrow columns, vertical layout, column rules, and multiple stories — *USA Today* also embraces the pacing and color of MTV, using many images (infographics and logos as well as pictures), varying the thickness of ruled lines, and combining unusual arrangements of typography with a constant, rigid page layout. *USA Today* breaks with tradition and with modernism as well. It is a study in contrasts, partly harking back to the decorative design of the Victorian era, partly drawing from recent movements in graphic design and illustration. Its breezy visual manner, a concern with surface effects combined with nostalgia and historical eclecticism, ties it to the contemporary movements in architecture and art that have come to be identified as *postmodern*.[1]

The purpose of this study is to compare the postmodern style identified in *USA Today* and its imitators with the modern style followed by newspapers such as the *Washington Post*. None of the previous research comparing newspaper design styles is completely adequate to the present task.

Previous Research

Most studies have tended to validate modern design, as a succinct survey of the research illustrates (Moen, 1989, p. 12–14). The researchers participated in the design tastes of their own day, and their studies reflected those tastes, often explicitly. It came as no surprise, for example, when Siskind (1979, p. 54) found that college-age respondents "preferred contemporary to traditional designs and well-designed pages to those of average design." Following a tradition that dates back at least to the Gothic period, Siskind unconsciously labeled the current style good (and, by implication, the previous style bad). In newspaper research, *modern* has been an accolade. The use of the term roughly coincides with the rise of modernism in newspaper design. Its first champion adopted the term (Allen, 1936), as did his successors (Arnold, 1969). In 1981, Garcia began the shift away from the term, although his approach was still modernistic.

The methodology of previous studies of newspaper style emphasized form over content. After viewing slides or printed copies of several pages of a modern or traditional newspaper front page, subjects were asked to rate the images on a series of bipolar adjectives. This method was followed by Siskind (1979) and by Pasternack and Utt (1986), and viewing was also the primary mode used by Sissors (1974) and by Click and Stempel (1974). Although they may not have directed subjects to focus explicitly on layout and design, the methods used in previous studies were clearly reactive, that is, by presenting slides or providing only a short viewing period, the studies clearly signaled their interest in the visual environment of typography, layout, and page appearance — rather than in the content — of newspapers. One study used nonsense headlines so that the subjects "would concentrate on the design" (Sissors, 1974, p. 308).

In previous studies, the subjects rated stimuli that had a large number of variables. One study of the characteristics of modern style listed 43 variables in typography, layout, pictures, and design elements such as ruled lines. The advantage of this method was that it provided a real-world setting not unlike the variability found in published pages. But that realism provided little understanding of the particular variables. To concentrate on the whole, previous studies treated the front page as the basic unit of design. Because modern and traditional styles differ in the number of stories on page

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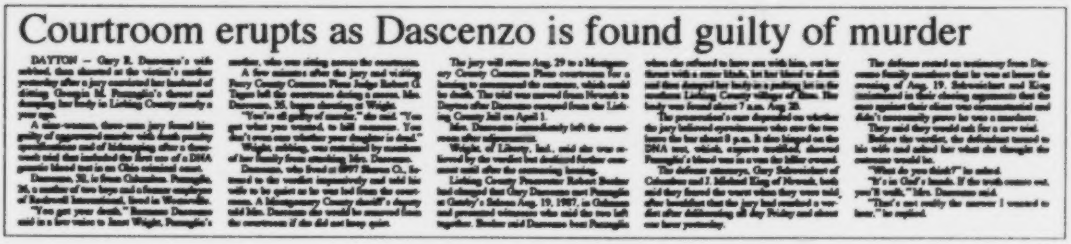
[1] ***Postmodernism*** is used narrowly here to refer to a recent historical shift in aesthetic style in the sense described by Pfeil (1986). This definition is less theoretically sophisticated than that suggested by Jameson (1984), Huyssen (1984), Stephanson (1987), and others, who view postmodernism as a broad cultural order, but the limited definition is useful here.



Courtroom erupts as Dascenzo is found guilty of murder

Figure 1. Modern style was depicted with a single text and display typeface and a thin box. This example is the hard news story in horizontal layout, reproduced here at roughly half size.

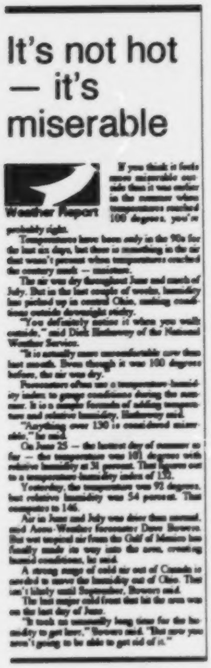
one, the content of the stimuli had to be different.

These variations in content, along with many variations in form, may account for some results that were contradictory. For example, Sissors (1974, p. 313) found that college students preferred traditional design, although the "radical differences" he identified in his stimuli do not seem quite so obvious today.

Another model for research, proposed by Barnhurst (1987a&b, 1991b), has suggested that the form or appearance of a news story affects the perception of its content. This hypothesis, that varying specific aspects of visual form produces subtle differences in what the reader perceives the *content* to mean, redefines the basic focus of design research. People use newspapers in many ways, and previous research tended, perhaps inadvertently, to measure one set of activities — what designers call *scanning* (Garcia, 1981, p. 2). But reading is at least as important as glancing or searching. Barnhurst sets aside scanning to focus on reading.

Scanning occurs within the larger field of the entire page, but once a story has been selected, reading occurs in a narrower field. In place of the entire page, Barnhurst proposed the individual article or clipping. When reading is the activity under study, the basic unit of design may reasonably shift to a narrower focus. This strategy sacrifices the wholism of earlier studies in order to measure precisely the subtle differences produced by individual variables.

The approach has begun to be tested empirically. A study by Middlestadt found that students who read the same news story perceived the content as more dynamic or comforting, depending on whether they read it in a vertical or a horizontal layout. Middlestadt held the content constant. Except for the difference in vertical and horizontal layout, the typographic design of the articles in her stimuli was identical. She also emphasized content over form by asking subjects to respond to the story. Her instructions made no reference to visual appearance until the debriefing. This method was non-reactive, that is, the subjects were unlikely to guess the purpose of the research and to adjust their responses accordingly. Finally, unlike earlier studies, Middlestadt's did not validate modernism. But the Middlestadt methodology was not created to measure style.



It's not hot — it's miserable

Weather Report

Figure 2. Postmodern style was evoked with contrasting text and display typefaces, heavy ruled lines, and a logo. This sample is the soft news story in vertical layout, reproduced here at roughly half size.

Style

Style is a complex and multifaceted phenomenon comprised of many individual formal qualities. The use of formal properties to examine stylistic change was pioneered by Wolfflin (1950) in the field of art history. The method is especially useful in visual communication because media images can be easily varied. A particular set of forms preferred at a given moment in design history combine to create what Barthes (1982, p. 197) called a "period rhetoric." Style is therefore closely identified with cultural changes over time. To expand Middlestadt's method to the broader issue of style, several carefully selected aspects of form, just enough to evoke the style, might be studied in combination to discover whether the style affects temporal perception of the content.

For the purposes of this study, modern and postmodern newspaper design styles had to be operationally defined. Modern style shares all the qualities listed initially, but the most obvious are these: the typical article is squared off, it runs undecorated, it has unified and matching typography, and its only border might be a fine-line box. To evoke the modern style, a single typeface was used, varying only the size of the headline from the text, and the story was boxed with a fine line. (See Fig. 1.) Postmodern style contrasts on each of the operational qualities of modern style. The typical article is not always squared off, it runs with an illustration, it has contrasting typography, and its decorative border might include a heavy ruled line. To evoke the postmodern style, a contrasting headline typeface was used, heavy lines or "ribbons" made up the border, and a visual image or "logo" was added. (See Fig. 2.)

The text typography in each style was identical. Following the example of the Middlestadt study, two articles were selected, one a hard-hitting news story and the other a human interest feature. In order to divorce the study from specific newspapers, the text was not drawn from either *USA Today* or any other recognizable national newspaper. Instead, two stories were chosen from the front page of the Sunday, August 14, 1988, Columbus (Ohio) *Dispatch*. The top story ran under the headline "Courtroom erupts as Dascenzo is found guilty of murder," and the bottom story concerned the weather: "It's not hot — it's miserable." These two articles were then produced in four versions, following the modern and postmodern styles, each in horizontal and vertical layouts.

The Research Questions

Generally, this study began with several questions. Would readers perceive the two news stories differently, as expected? Would a cluster of typographic variations produce the same effect Middlestadt found for a single variable? But the key question was whether readers would perceive time-related differences when confronted with different styles. Although this study was exploratory, it began with three hypotheses:

Hypothesis 1. Readers would perceive the two stories differently. This prediction may seem rather obvious, but it is important to note that each subject would read and respond to only one story. By confirming this hypothesis, that is, rating the hard-hitting murder story differently from the softer weather story, readers would not only reflect the common sense of these differences but would also provide a point of comparison for any more-subtle differences perceived due to style. Thus the first hypothesis sets up a maximum expected range of perceptual variation.

Hypothesis 2. Readers would find the different styles to have effects similar to those Middlestadt found. Specifically, they might find the postmodern style (and the vertical layouts that help to signal the style) more comforting but no more dynamic than the modernist versions. This prediction would confirm but not replicate the findings of Middlestadt, whose analysis of layout direction controlled all other typographic differences. Studied in isolation, layout direction suggested a mood or tone, and the second hypothesis proposes that style differences will have the same effect.

Hypothesis 3. Readers would perceive subtle, time-related differences in the content of a story as a result of its visual design. More specifically, this hypothesis predicted that the effects of design on content suggested by Barnhurst would be time-related when invoking a style period. Readers who were sensitive to design might place modernism first in chronology and identify postmodernism as younger or more recent. But even without a detailed knowledge of design history, readers would be expected to perceive time differences in the stimuli.

The Study

Subjects were 275 undergraduates in introductory psychology classes at the University of Kentucky. College students are the focus of intense interest to newspaper publishers, who must attract them to assure a continued readership over time. Although college students alone are not representative of the actual readership of most newspapers, they are an important constituency.

The subjects were each asked to read one of the actual news stories, selected at random, although they did not know its source. Of those who received the weather story, the modern style was read by 34 in horizontal layout and 35 in vertical layout, and the postmodern style was read by 40 in horizontal and 32 in vertical layout. Of those who received the murder story, the modern style was read by 32 in horizontal layout and 35 in vertical layout, and the postmodern style was read by 33 in horizontal and 35 in vertical layout.

The Scales. After they had finished reading the article, they were asked to rate the content on a 7-point scale for 24 bipolar adjective sets selected from the previous research. The scales included three dimensions: comfort, dynamism, and a time measure. The comfort scales used in this study were the nine identified by Middlestadt: *comforting / discomforting, violent / gentle, pleasant / unpleasant, heavy / light, soft / hard, cool / warm, sweet / bitter, awful / nice,* and *beautiful / ugly.* Middlestadt also identified a dimension called "dynamism," for which the following scales were used in this study: *playful / serious, agitated / calm, energetic / lethargic, detailed / plain, and adorned / unadorned.*

The third dimension, developed earlier in a pilot study, included two sets of scales related to temporal perceptions. Bipolar adjectives referring to an age or time measure included *old / new, mature / youthful, timeless / trendy, formal / informal,* and *uniform / varied.* A second set referring more specifically to the *evaluation* of old and new design included *conventional / unconventional, predictable / unpredictable,* and *expected / surprising.*

Results. Data were analyzed with a 2 by 2 by 2 (Story type by Style type by Layout direction) multivariate analysis of variance (MANOVA). A significant main effect of story type was revealed, $F(1,206) = 26.31$, $p < .001$. Univariate tests revealed the murder story to be less *comforting, conventional, playful, sweet,* and *beautiful,* and more *agitating, varied, violent, energetic, heavy, hard, cool,* and *awful.* (All p's < .001 except for *varied,* which had a p value of .009.)

Style was found to affect individuals' perceptions of the article for the adjectives *informal, ugly,* and *new.* The postmodern style was seen as less formal than the modern style, $F(1,229) = 5.43$. $p < .05$. The postmodern style was also seen as uglier, $F(1,229) = 6.36$, $p < .02$. At the marginally significant level, the postmodern style was seen as older than the modern style, $F(1,229) = 3.08$, $p < .10$.

Direction was found to affect individuals' perceptions of the article for the adjectives *youthful, uniform,* and *new.* The horizontal layout was perceived as less mature (more *youthful*) than the vertical layout, $F(1,229) = 4.07$, $p < .05$, and as less varied (more *uniform*) than the vertical layout, $F(1,229) = 3.91$, $P < .05$. At a marginally significant level, the vertical layout was perceived as newer than the horizontal layout, $F(1,229) = 3.47$, $p < .10$.

Discussion

The main effect of story type was found on 14 of the 24 scales, indicating that the two stories (weather and murder) were perceived differently. Thus the first hypothesis was supported. The results are consonant with the commonsense notions of the difference between a hard news murder story and a softer news feature about the weather. This result was expected and is of interest principally because it indicates the high end of perceptual differences found with the scales. That a fairly obvious effect showed up in fewer than two-thirds of the scales suggests that subtle differences might be hard to detect.

An effect of postmodern style was found on only one of the 9 scales from Middlestadt's "comfort" dimension, and no significant effects were found in the "dynamism" scales. The postmodern style was considered uglier, as predicted. Thus the second hypothesis was not supported. The explanation for this failure to support the second hypothesis was not wholly unanticipated. The study did not precisely replicate Middlestadt because several typographical differences were included simultaneously. The increased variation in the stimuli may have, in effect, muddied the waters, especially considering the limited sensitivity of the instrument. To the question of whether style produces an effect similar to that of layout direction, this study would suggest the answer no.

Table 1

Mean response as a function of story type, design style, and layout direction

	New	*Informal*	*Youthful*	*Uniform*
Weather feature				
Modern				
Horizontal	4.3	4.2	3.8	4.8
Vertical	4.3	4.2	3.3	4.9
Postmodern				
Horizontal	3.6	5.1	3.9	4.6
Vertical	4.5	4.0	3.3	5.1
Murder news story				
Modern				
Horizontal	4.5	3.8	3.3	4.1
Vertical	4.7	3.9	3.4	4.8
Postmodern				
Horizontal	4.0	3.9	4.2	4.0
Vertical	4.3	4.9	3.6	4.4

Higher numbers imply the article was viewed as newer, or as more informal, youthful, uniform, or ugly.

The effects of style and layout are shown in Table 1. At the significant or marginally significant level, effects were found on 4 of the 5 scales referring to the time dimension, but no effects of the time-evaluative dimension turned up. In total, effects were found in half of the 8 scales in the time dimension, a proportion only somewhat smaller than that found for all dimensions in the obvious effect of story type. Thus the third hypothesis was supported.

Although significant differences were detected, the direction of difference was not uniform. Postmodern style was seen as less formal but was also seen as older. The vertical layout associated with postmodernism was seen as newer than modern layout but it was also considered more mature and uniform. Although readers found the contents of the stories different when read in different design styles, they did not consistently identify modernism as older than postmodernism.

After the fact, this result appeared to be reasonable, given the nature of stylistic change. Postmodern style was introduced early in the 1980s, but modern style was seeing a resurgence in the latter half of the decade. In other words, both styles existed simultaneously in contemporary experience.

Layout direction has similarly complex historical roots. Horizontal layout was a relatively recent innovation of the 1970s, but vertical layout is both older, being a standard of traditional layout before the rise of modern horizontal layout, and more recent, having had a resurgence with the rise of postmodernism in the 1980s. Because it draws on historic styles, postmodern layout can be seen as both old and new.

Furthermore, the perception of age might be affected by which style or layout the students were already familiar with or by the order in which they first encountered them in past experience. The respondents were generally freshmen at the University of Kentucky and were presumably familiar with the style of *USA Today*. No information was gathered on the students' familiarity with newspapers.

Another informal observation is that the effects were sometimes contradictory for different stories. Middlestadt observed that the nature of the interaction between story type and design variables was extremely complex. Further analysis of the phenomenon was beyond the scope of this experiment.

The significant result of this study, besides the expected finding that the content exerted a main effect on perceptions, is to suggest tentatively that visual style, defined with a minimum of contrasts in the formal properties of the layout, affects the temporal perception of the story. This finding is especially interesting because the text typography (the typeface, size, spacing, and column widths) was identical in the two styles.

Rather than confirming Middlestadt's finding that the direction of the layout had some effect on the perception of the story, this study suggests that the effects of style and of layout direction are not the same. Finally, the results suggest that, viewed from the perspective of contemporary readers, design periods are not clear-cut breaks in a linear trend over time but involve a complex phasing-in as one design style supplants another.

Further Study

This study was necessarily preliminary and exploratory, and the results suggest several other directions for further research. One would be to include traditional along with modern and postmodern styles. Another would be to analyze reader exposure to different design styles. A third would be to break out the stylistic differences, measuring individually the effects of headline typeface, weight of ruled lines, and use of a logo.

Middlestadt's study also requires exact replication, and her indirect method of measuring the response to form requires analysis and validation. Both writing and design contain information that has functional use to the newspaper consumer, and both also have an aesthetic or taste aspect. Further study might seek to separate these factors and to clarify the complex effects of content and style.

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The Effects of Gray Shades in Instructional Materials Produced with Desktop Publishing Software

Nancy Nelson Knupfer
Marina Stock McIsaac

Desktop publishing software has revolutionized printing and publication, and offers the novice a wide range of techniques formerly available only to professional layout artists. Now anyone can design and produce their own instructional materials by transforming existing art into professional quality work that can be pasted into a variety of text formats.

Desktop publishing computer programs have individualized the page layout process and have provided sophisticated enhancements for mixing text and graphics for computer users who have no training in either instructional development, page layout, or graphic design. People who use such computer software to design instructional materials are faced with a vast array of newly developed features with little or no guidelines for their effective use. Even when guidelines are provided, they are often confusing. Teachers and trainers who use computer programs to design instructional materials and integrate visuals into the text are asking for guidelines.

Although certain features of electronic text can be transferred to printed text, there are many differences between the two which suggest that separate studies be done. The size of the screen or page, the type size and the ability to scroll are but a few of the differences which affect print and electronic text comparison studies. Because of these differences, a programmatic series of investigations is needed to examine the effects of these recent technological enhancements in each of the two media formats.

The purpose of this study was to investigate the effects of gray shading on reading speed and comprehension. Graphics were placed within reading materials so that the graphic shape was shaded with gray. Three treatments were employed, each using a different degree of gray shading, and a control group with no graphics was included for comparison.

Background

Research concerning the various mixtures of graphics and text has centered around four basic areas: graphic design, instructional text design, instructional graphics, and, more recently, computer design of materials for on-screen or printed display.

The emphasis in the area of graphic design has been on the importance of balancing text with white space, improving the aesthetics of the page, and positioning graphics as the dominant visual element (Parker, 1987). This type of research does not usually question the content of the graphic, but simply its placement within the text. In contrast, research in the area of reading indicates that the type of graphic is an important variable in reading comprehension, but becomes less important in reality because most students don't attend to the graphics (Reinking, 1986). For example, simple graphics at the pictorial level might not make a difference in reading speed or comprehension, but graphics which are designed at the inferential, generalized, and evaluative levels of understanding can help students grasp the meaning of the text (Reinking, 1986; Singer & Donlan, 1980). Additionally, research on learning suggests that designers should develop materials for graphic thinkers, not just graphic readers, and thereby address the cognitive processes more directly (Boyle, 1986).

Instructional designers can find some principles for text design within the works of Hartley (1991, 1985), Heines (1984), and Jonassen (1982). Page layout is one variable which has been identified as having a significant effect on reader's speed and comprehension. But the layout variables in text research usually do not address the question of graphic content or placement, and typically are limited to type style, upper-lower case, character attributes, line length, and justification.

Research on instructional graphics is inconclusive. It reveals no empirical evidence that learning is improved by using graphics in instruction, but it is possible that the graphics used in that research were representative of concepts already familiar to the readers (Merrill & Bunderson, 1981). More sophisticated instructional graphics, such as pictorial, symbolic, schematic, or figurative displays, can be effective in teaching, and the visualization of abstract ideas through figurative displays may very well enhance learning (Nygard & Ranganathan, 1983).

Nonsignificant differences were reported for research that compared reading comprehension using computer screen versus printed text (Gambrell, Bradley, & McLaughlin, 1987). Yet eye fatigue seems to play an important role in reading from a computer screen. Despite the similar result in comprehension scores, students reported more difficulty reading from the computer screen than from printed text (Hathaway, 1984; Mourant, Lakshmanan, & Chantadisai, 1981). Although the research on electronic and print-based materials have differing variables which are specific to the medium, certain features apply to both, including text density, upper-lower case, and typographic cueing (Hartley, 1987; Hathaway, 1984; Morrison, Ross, & O'Dell, 1988; Ross, Morrison, & O'Dell, 1988).

Page layout, typographic cueing, and representation of graphic material in print-based text have been investigated by several researchers. For example, Hartley (1985) determined that page size affects other layout decisions. In addition no significant differences were revealed in some studies that compared the effects of justified and unjustified text on reading speed and comprehension (Campbell, Marchetti, & Mewhort, 1981; Muncer, Gorman, Gorman, & Bibel, 1986). Yet according to Jonassen (1982) the issue remains unresolved. Jandreau, Muncer, and Bever (1986) have investigated the effects of varying spaces between phrases in sentences. Still others have examined certain design features common to printed and electronic text in the presentation of graphic materials (Alesandrini, 1987; Poggenpohl,1985; Winn,1987; Winn & Holliday, 1982). Hartley (1987) and others have stated a need for more research on this topic.

Even though electronic text and printed text share many features in common, there are several differences between the two which suggest that separate studies be done. For example, the size of the screen or page, the type size and the ability to scroll are just a few of the differences which affect print and electronic text comparison studies. Because of these differences, a programmatic series of investigations is needed to examine the effects of these recent technological enhancements in each of the two media formats. Recently, Morrison, Ross, and O'Dell (1988) examined attributes of computer-based instruction, and various attempts to affect those attributes by regulating text density for print-based and computer-based lessons. Results of their work suggested that print-based materials had more advantages than the computer-based materials in achievement, completion time, and learning efficiency for a statistics lesson. Given this, the present study is limited to the examination of print-based, computer-generated text.

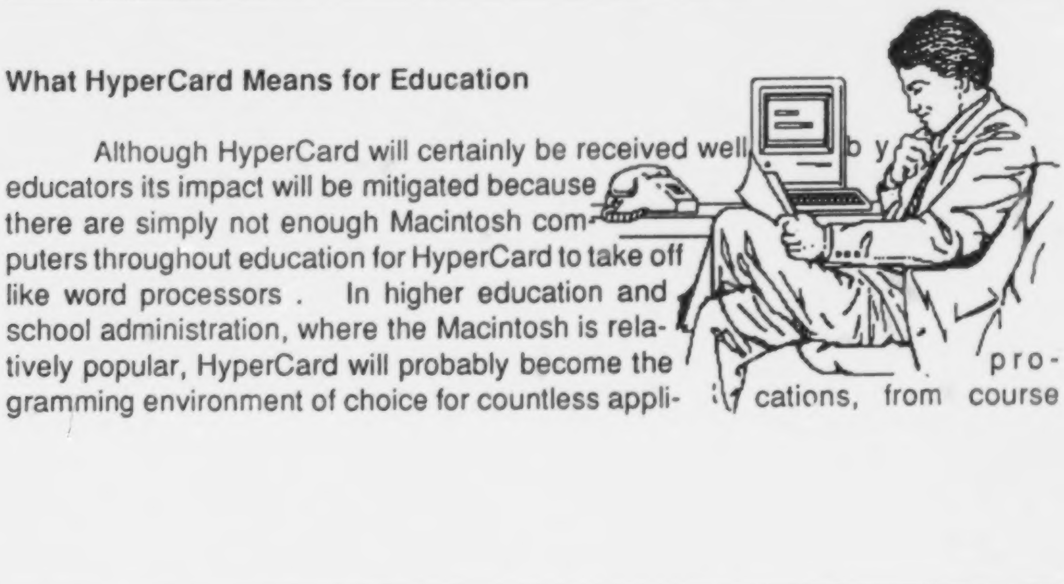
Purpose

There is a dearth of reported research on graphic variables in instructional text which can influence guidelines for using the emerging capabilities of new computer software programs (Hartley, 1991; Isaacs, 1987; Knupfer & McIsaac, 1990a). Recently, some guidelines have been suggested by research concerning the mix of graphics and text within instructional materials produced with desktop publishing software. Knupfer and McIsaac (1990a) recommend using the wrap-around text style which conforms to the shape of the graphic (Figure 1) as opposed to the run-around text style which boxes the figure (Figure 2). They also suggest using less than one-half inch of white space between the graphic and the text (Knupfer and McIsaac, 1991).

For many years, graphic designers have emphasized the importance of using white space for balancing text, positioning graphics, and improving the aesthetics of the page layout (Parker, 1987). Now, Hartley (1991) suggests that designers pay greater heed to the functional issues as opposed to the aesthetic issues surrounding the creation of printed materials using desktop publishing software.

One feature of computer-generated text is the ability to shade the area behind the text or the graphic. In a tangential vein, Rickelman and Henk (1990) have investigated the use of colored overlays and tinted lens filters to benefit readers with a visual perceptual problem known as Scotopic Sensitivity Syndrome. Along the same line of inquiry, Robinson and Miles (1987) concluded that such readers can do best when provided with overlays that maximize visual efficiency and are the same color throughout the piece. Yet no one has investigated the effects of varying the shades of gray that are used within instructional materials for

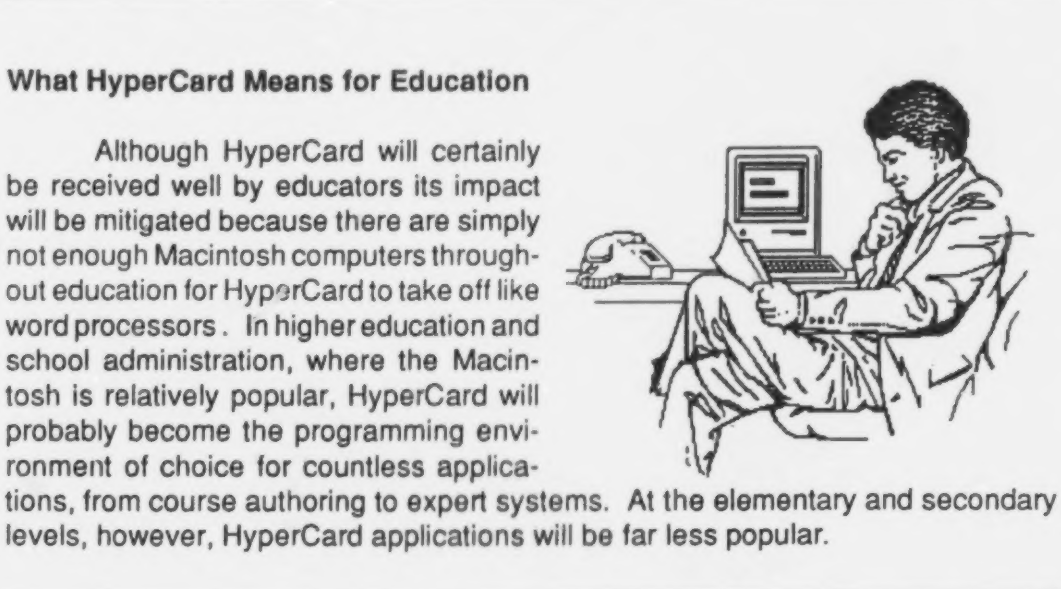
Figure 1
Wrap-Around Text



What HyperCard Means for Education

Although HyperCard will certainly be received well by educators its impact will be mitigated because there are simply not enough Macintosh computers throughout education for HyperCard to take off like word processors . In higher education and school administration, where the Macintosh is relatively popular, HyperCard will probably become the programming environment of choice for countless applications, from course

Figure 2
Run-Around Text



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typical readers with no known physical limitations.

The purpose of this study was to investigate the effects of gray shading on reading speed and comprehension. Graphics were placed within reading materials so that the graphic shape was shaded with gray. It was hypothesized that graphics with darker gray shading would be most likely to interfere with reading, thus producing slower reading speed and less comprehension than pieces with no graphics or lightly shaded graphics.

Method

Subjects

One hundred fifteen students from an introductory computer literacy course at a major university in the Southwest were the subjects for in this study. The course was offered to students as an elective to meet a General Studies numeracy requirement. Students were sophomores, juniors, and seniors who had very little or no prior experience using a computer. This study was conducted during the first week of the semester before the students encountered the information presented in the textual material. All students in the course participated in the study.

Materials

Readings. Approximately six pages of informative text about Hypercard and desktop publishing composed the body of the readings. These particular materials were chosen because the topic was relevant to the course and because the reading level was geared for the general public as opposed to technical readers. The readings were composed of a topic and style that were suitable for a novice audience with no prior knowledge about either Hypercard or desktop publishing. Using the Flesch-Kincaid Readability formula, the text was analyzed and found suitable for readers between the 11th and 13th grade levels.

Four sets of reading materials were used for this study. All included the same arrangement of text within a single column format. Set one was used as a control because it did not contain any graphics at all (Figure 3). Sets two, three, and four each contained 12 identical graphics which were placed in the text using the wrap-around technique in which the text conforms to the shape of the graphic. The only difference between these three sets was the degree of gray shading applied to the graphics. Set two had transparent graphics with no gray shading at all (Figure 4). Set three had ten percent gray shading of the graphics (Figure 5). And, set four had forty percent gray shading of the graphics (Figure 6).

The simple, pictorial graphics were meant to be motivational and were linked to the text by interest. Even though they were not critical for the understanding of the textual material, the graphics very well could have promoted understanding through illustrative associations.

In the hypercard article, the graphics included a Macintosh computer with a set of linked cards on the screen corresponding to an introductory paragraph describing hypercard and the machinery it runs on, a stack of index cards representing Hypercard's index card analogy, a set of books representing

Figure 3
Group One - Text with No Graphics

What HyperCard Means for Education

Although HyperCard will certainly be received well by educators its impact will be mitigated because there are simply not enough Macintosh computers throughout education for HyperCard to take off like word processors . In higher education and school administration, where the Macintosh is relatively popular, HyperCard will probably become the programming environment of choice for countless applications, from course authoring to expert systems. At the elementary and secondary levels, however, HyperCard applications will be far less popular.

Figure 4
Group Two - Transparent Graphics

What HyperCard Means for Education

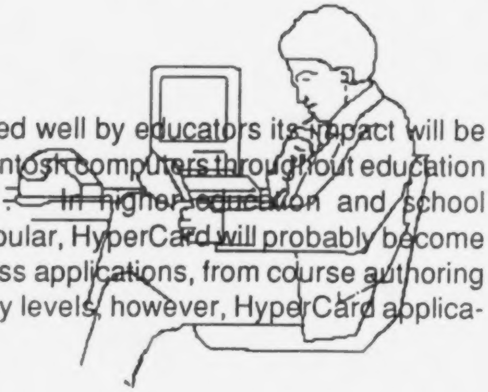

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Figure 5
Group Three - Graphics with Ten Percent Gray Shading

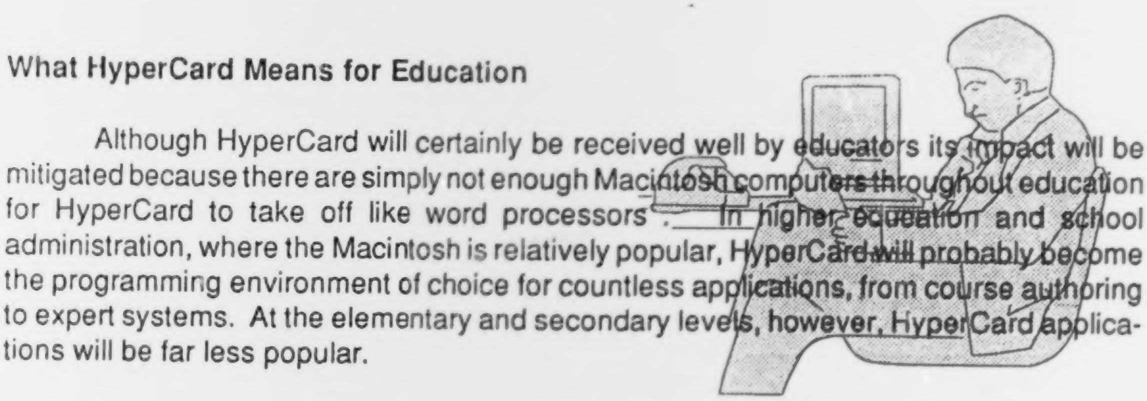

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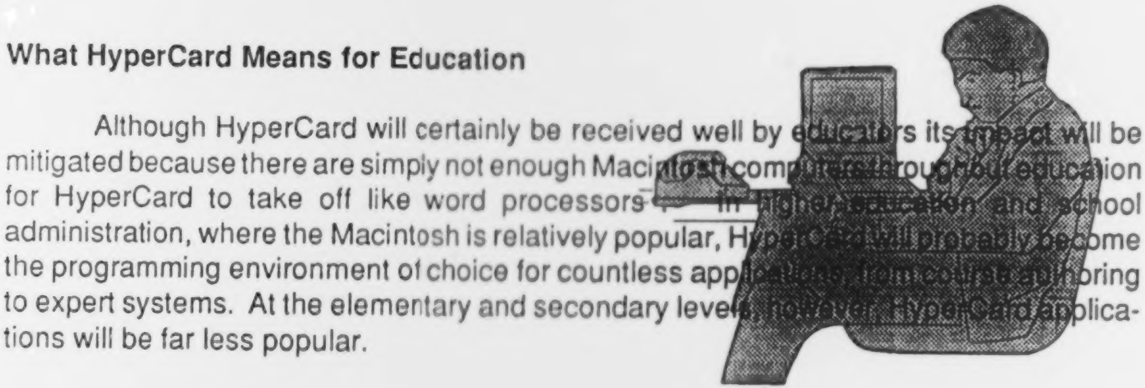
Figure 6
Group Four - Graphics with Forty Percent Gray Shading



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computer manuals, an organizational chart representing the five levels of hypercard application, an educator sitting at a computer representing Hypercard's impact on education, a teacher and an administrator discussing the potential of Hypercard in schools, a set of computer disks representing Hypercard's impact on new software development, and finally, a newsletter and newspaper set representing the important evolutionary step in computing attributed to Hypercard. The desktop publishing article displayed a desk to represent the desktop publishing concept, a hand on a mouse where the text explains that various desktop publishing programs support mouse usage, and a set of black and white tack pins representing the concept of the same yet different, to coincide with the text's explanation concerning variations in the same desktop publishing software to accommodate the MS-DOS and Macintosh environments.

The graphics were placed within these reading materials in a consistent manner throughout the three experimental groups. Since no consultation occurred with an expert graphic designer, this placement should be indicative of common practice among lay people who might be using desktop publishing. Therefore, any flaws in the materials design are potential problems that other teachers and trainers might exhibit as well.

The percentage of gray shading varies with different desktop publishing programs. Among the various programs, Pagemaker is known to be the most true in terms of percentage measurements of gray. Therefore, Pagemaker was used to produce the materials and each document was laser printed on the same printer to avoid possible variations caused by xeroxing.

Pretest and Posttest. In order to determine the students' comprehension of the reading material, a pretest and a posttest were developed from key concepts within the readings. The test questions were based upon the textual material alone; no test items were dependent upon the information contained in the graphics. The tests were developed and validated during a previous phase of the project, and were found to be reliable at the .76 level using the KR20 formula. The pretest and posttest were nearly identical; each contained the same 34 multiple choice and 11 completion questions utilizing the fill-in-the-blank format. Those questions measured both recognition and recall comprehension skills. In addition to those questions, the three groups with graphics were asked to recall as many graphics as possible on the posttest. They were told that there were 12 graphics to recall.

Procedure

The subjects were given a pretest to determine any significant differences in their knowledge of the subject prior to reading. There was no time limit and students were free to take the time they needed to complete the test. Following this, the students received instructions for reading the materials and for taking the posttest. They were told to wait with the materials face down until they were signaled to begin. Then they were to read the material through one time without hurrying, record their reading time, and receive a posttest.

The four sets of reading materials were randomly distributed to the students so that each student received one set of articles. When subjects were finished reading, they recorded their times from a master timekeeper who posted times to the half second. Proctors observed the students to make sure that their times were recorded correctly. Immediately following the reading, the subjects were given the posttest. They were allowed as much time as they needed to complete the test.

Analysis

Analysis of variance (ANOVA) determined that there were no significant differences in the pretest score among the four groups. So, comprehension was measured by the posttest score and tested for differences using ANOVA on the four groups. Independent variables were the four graphic variations, which included no graphics, graphics with no gray shading, graphics with ten percent gray shading, and graphics with forty percent gray shading. The dependent variables included reading speed and comprehension. ANOVA was also conducted on the graphic recall question for groups two, three, and four. The alpha level for significance was set at .05.

Results and Conclusions

The ANOVA revealed a significant difference in comprehension among the four groups. Scheffe posthoc analysis showed that difference to be between groups one and three. Group three, with ten percent gray shading comprehended significantly less than group one, with no graphics. There were no significant differences in reading speed between the four groups. Table 1 shows the mean comprehension scores for the four groups on the posttest. Table 2 shows results for the ANOVA for comprehension between the groups.

Contrary to what one might expect, the group with forty percent gray shading did not comprehend less than the group with ten percent gray shading. So, the darker gray shading did not interfere with comprehension.

The ANOVA testing for differences in the number of graphics recalled between the three groups that employed graphics, revealed no significant differences. Low mean scores, ranging from 1.1 to 1.9 out of a possible 12 graphics, indicate that no group remembered very many of the graphics. This, along with similar reading speed between the groups, supports Reinking's claim that readers do not really pay attention to pictorial graphics (1986).

This research indicates that people who produce materials with desktop publishing software should avoid using graphics with ten percent gray shading. It is preferable to use no graphics at all or to use graphics that are outlines only or contain a darker gray contrast, such as forty percent.

It is possible that reading speed and comprehension using these shaded graphics configurations could vary dependent upon the type of graphic used. Therefore, future research should be conducted using a variety of types and sizes of graphics, including those which are more critical to the meaning of the text.

Table 1
Reading Comprehension Posttest Scores
Means and Standard Deviations

Group	Graphic Style	n	M	SD
One	None	30	44.66	16.66
Two	Transparent	31	38.16	14.99
Three	10% Gray	29	32.24	12.42
Four	40% Gray	23	37.78	14.19

Table 2
Summary of ANOVA
Reading Gain by Format

Source	DF	Sum of Sq.	Mean Sq.	F	p
Between Groups	3	2287.27	762.42	3.52	.01
Within Groups	109	23562.08	216.16		
Total	112	25849.36			

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Instructional Implications of Visual and Verbal Short-Term Memory Capacity Differences Among Children

Frank P. Bazeli
Peter T. Bazeli

In 1956, George Miller published an article in the Psychological Review entitled, "The magical number seven, plus or minus two: Some limits on our capacity for processing information." Miller, in the article, summarized his own studies and research by others that found that our short-term memory appeared to have a limited capacity to hold information. For the overwhelming majority of normal adults this capacity appeared to be in the range of from five to nine items of information. Through a process of chunking or grouping together more information could be held but still, apparently, within the limits of no more than nine such chunks. Miller's article led to the development of a major line or research that continues to be active and informative today.

This paper reports the results of a study on age differences in short-term memory capacity when information is presented verbally, visually, and in combination. It, too, stems from Miller's seminal work. These findings along with those reported in the literature review will form the basis for some suggestions on instructional strategies.

Short-Term Memory Research

Miller's (1956) initial review of short-term memory research related to pitch, loudness, taste, brightness, color, hue, size, length, letters, digits and other such items reported always encountering the stated limitation. Miller's suggestions to overcome the limitation included rehearsal and chunking of information into larger units. Subsequent studies by Case (1974, 1975), Parkinson (1969), Pascual- Leone (1969), Scardamalia (1973), have come to similar conclusions. Further, they found clear differences over age groups with children having an increasing capacity until reaching adult levels in the middle teen years.

Pascual-Leone (1969) constructed a Neo-Piagetian functional theory of cognitive development that used the findings on short-term memory as a central anchor. Briefly, the theory proposes that humans develop three sorts of schemes (schemas). Figurative schemes correspond roughly to Miller's chunks. They are internal representations of groups of information or perceptual features that are recognizable. An example would be a house scheme. Operative schemes are transformations or processes. They are internal representations of functions or rules which can be applied to one set of figurative schemes to generate a new set. A third sort of scheme, executive schemes, are internal representations of procedures which can be applied to reach an objective or solve a problem. Executive schemes are used to select and bring to bear operative schemes on figurative in appropriate situations. When a new figurative scheme is produced that corresponds to the objective the executive scheme terminates the procedure. The new scheme is added to the repertoire of schemes for future use.

In the course of every day living we are constantly applying, modifying, and increasing the complexity of our repertoire of schemes (Case, 1974). How many such schemes can be activated at any one time is limited by our mental effort capacity (M-power) which varies across and within age groups. Across age group differences are assumed to be due to maturation. For normal children M-power appears to increase linearly with age. Second graders aged 7-8 appear to have a capacity of $e + 3$ schemes, where e stands for the mental effort (energy, capacity, or space) required to activate an executive scheme, and 3 is the number of items of information. Fourth graders appear to have a capacity of $e + 4$, seventh graders a capacity of $e + 5$, and high schoolers $e + 7$ schemes (Case, 1974).

Learning anything new requires a match between what we already know and the functional limits of our thought processes at that stage in life. Case (1975) suggests that children and adults fail to learn because first, the information to be learned is greater than the information-processing capacity which is available, and second, the spontaneous way in which the learner approaches a problem may be incorrect, and there is not enough M-power left to overcome this approach without help.

Case suggests further that teachers need to look at problems from the learners' perspectives and state of knowledge by analyzing their errors and justifications. Along with reducing the hierarchy span of what is to be learned to match short-term memory capacity, comparing natural but incorrect responses to correct responses within a more inclusive scheme may be an effective approach.

Recent studies regarding short-term memory have explored other questions related to differences among subjects and types of presentations. Chen and Stevenson (1988) compared pre-school American and Chinese children on their ability to process digits in their own language. They found that Chinese children have a greater capacity than American children. They reported that this was consistent with studies comparing Chinese and American adults. Typically, Chinese adults have a span of nine to ten digits compared to only seven for American. Chen and Stevenson concluded that the key reason for the superiority was due to the fact that the pronunciation of numbers in Chinese takes less time than in English. This introduces a time factor into M-power or M-space. Gary Price (1989) reviewed research on mathematics skills in early childhood. He concluded that learning these skills is related to previous learning. Familiarity with numbers and with addition and subtraction facts increases working memory capacity, apparently because of chunking and schema complexity.

Two studies, one by Hitch, Wooden, and Baker (1989) and the other by Neath and Crowder (1990) explored capacity of children to re-call information presented verbally and visually. They found, among other things, that visual short-term memory tended to be stronger than auditory short-term memory. Neath and Crowder also found that auditory short-term memory was more unpredictable.

Hitch, Wooden and Baker concluded that older children's recall of auditory information is sometimes impaired by phonological, that is, sound similarity, among the names of the items. Younger children tended to be not as confused as older children when conflicting items are presented both verbally and visually. Their explanation was that younger children ignore sound information when items are presented in both visual and verbal form. Older children's visual short-term memory when presented with conflicting verbal information is sometimes masked by the sound of the words. An example of this is the identification of a pictured cap as a hat when the word "hat" is at the same time presented verbally. Hitch, Wooden, and Baker did not test the strength of identification when the picture and the names were the same.

Purpose

The purpose of this study was to confirm the results of previous studies regarding the linear, age related, development of short-term memory capacity in children and to determine differences in capacity when information is presented verbally, visually, and in a format where the same information is presented simultaneously both visually and verbally. Findings in the research literature suggest that visual short-term memory capacity may be larger than auditory short-term memory capacity. Conventional wisdom holds that presentation of information through more than one sensory channel will result in better recall. The hypotheses of this study were:

Hypothesis 1: The mean number of digits held in short-term memory will increase as the age/grade level of subjects increases.

Hypothesis 2: At each grade level the mean number of digits held in short term memory will be higher when presented visually than when presented verbally, but lower than when presented both visually and verbally in combination.

Methodology

Subjects. The subjects tested in this study were 83 students in the 2nd, 4th, 7th grades and high school sophomores in intact classroom groups of between 18-25 students each. The samples were drawn from one elementary, one middle school, and one high school located in two adjacent small cities in Northern Illinois.

Procedures. The previously identified classes were tested separately. In each class the investigator explained the purposes of the study and how the experiment would be conducted. Subjects were given one practice trial for each of the sub-experiments. In sub-experiment one the subject group was shown on large cards nine sets of digits ranging from sets of one digit to nine. The subjects recorded these on prepared record sheets after each presentation. The investigator held each card up for a length of time to match one-half second per digit. Sub-experiment two was a verbal presentation of another nine sets of digits with the subjects again recording each set following its presentation. In sub-experiment three the investigator both showed and read another nine sets of digits carefully keeping to a measured presentation to avoid grouping. The subjects recorded these sets in the same way as in the previous sub-experiments.

Statistical Analysis. The study employed a one-tailed analysis of variance between groups to test Hypothesis 1. A two-tailed multiple analysis of variance within groups was used to test Hypothesis 2. An Alpha=.05 was used to determine statistical significance.

Results

Table 1 provides a summary of the statistical results of the one-tailed analysis of variance between groups. findings indicate that there is significant difference between age groups in each of the three presentation formats. For verbal presentations the F probability was .0003; for visual presentation the F probability was .0000, - and for combined presentations the F probability was .0011. In all cases there was steady linear increases in capacity of short-term memory as grade levels increased.

Table II summarizes the results of the multiple analysis of variance within grade level groups. At the second grade level recorded means were verbal 4.333, visual 4.222, and combined 5.333 resulting in significant differences in short-term memory recall of combined over verbal and combined over visual presentations. At the fourth grade level recorded means were verbal 4.762, visual 5.191, and combined 5.619 resulting in no significant differences among presentation formats. At the seventh grade level recorded means were verbal 5.400, visual 6.240, and combined 6.080 resulting in significant differences in recall of visually over verbally presented number sets. At the high school level recorded means were verbal 6.263, visual 6.947, and combined 6.895 resulting in significant difference in recall of visually presented over verbally presented number sets.

Table I

Grade Level Analysis of Variance in Digit Set Recall

TestType	DF	Sum of Squares	Mean Squares	F Ratio	F Probability
Verbal	3	40.0243	13.3414	6.9572	.0003 *
Visual	3	81.6133	27.2044	12.6527	.0000 *
Comb.	3	26.4061	8.8020	5.8640	.0011 *

N = 83 *indicates significance at the 0.05 level

Table II

Multiple Analysis of Variance Within Groups of Diget Set Recall Using Different Presentation Methods.

	Mean	SD	t	DF	P
Grade 2(N=18)					
Verbal	4.333	1.328			
Visual	4.222	1.734	.2.4	17	.811
Verbal	4.333	1.328			
Comb.	5.333	1.749	.2.64	17	.017*
Visual	4.222	1.734			
Comb.	5.333	1.749	.2.40	17	.028*
Grade 4 (N=21)					
Verbal	4.762	1.446			
Visual	5.191	1.692	-1.06	20	.303
Verbal	4.762	1.446			
Comb.	5.619	1.117	-2.03	20	.055
Visual	5.191	1.692			
Comb.	5.619	1.117	-1.11	20	.282
Grade 7 (N=25)					
Verbal	5.400	1.500			
Visual	6.240	1.200	-2.72	24	.012*
Verbal	5.400	1.500			
Comb.	6.080	.909	-1.87	24	.074
Visual	6.240	1.200			
Comb.	6.080	.909	.50	24	.621
High School (N=19)					
Verbal	6.263	1.195			
Visual	6.947	1.224	-2.11	18	.050*
Verbal	6.263	1.195			
Comb.	6.895	1.100	-2.05	18	.055
Visu6.947		1.224			
Comb.	6.894	1.000	.29	18	.772

*indicates significance at the 0.05 level

Discussion

The findings of the study agree with those in the literature review that report a linear development of short-term memory capacity in children with age. Means in this study tended to be similar to those found previously. Main findings by Hitch, Wooden and Baker (1989) and by Neath and Crowder (1990) are also at least partially supported by the findings of this study. The hypothesis that information presented in a combined format would result in higher recall means than those visually presented was not supported. There appears to be little difference between the two presentation styles. It may be that, as in the Neath and Crowder study, two or more channel presentations interfere with processing by a number of older subjects who may have constructed other cognitive strategies to encode such content, or who are functioning at their maximum capacity.

Instructional Implications

The linear development of short-term memory capacity appears to be well-established. A first implication of this finding is that instruction needs to be geared to below the magnitude of student capacity at each grade level. It also appears that visually presented information or information presented verbally and visually together are superior in most instances to telling. This supports the usefulness of graphic organizers of many sorts. However, there appears to be some evidence that suggests that multiple media presentations may take up too much of learners' short-term memory capacity leading to interference and diminishing outcomes as new information increases. This, in combination with the probability that short-term memory capacity is also taken up in resolving differences between preconceptions and "correct" schema structure, will ensure that the magnitude of capacity demand in many learning tasks will lead to overload and failure for some students.

As a rule of thumb second graders ought not be asked to handle new information that contains more than two or three steps or components at one time, fourth graders more than three or four, seventh graders no more than four or five, and high school students no more than five or six. Presentations of new information ought to include combinations of visual and verbal media, but teachers should be careful to limit simultaneous multi-media presentation of information; they appear to be more distracting than helpful to some students. In addition to the amount of information presented, learners bring to the situation preconceptions and natural responses typical of their intellectual growth which may help or hinder new learning. Teachers need to pay careful attention to student errors in first trials at new learning. Those errors reveal patterns of thinking and misconceptions that cannot be ignored or they will persist. Usually the best strategy is to include the errors being made as part of the lesson by comparing them to correct responses within the framework of the schema being developed.

A teacher sensitized to the limitations of short-term memory capacity would think about anything new to be taught from both the instructional design perspective and from the current knowledge and capability perspectives of the students. At first, in new learning situations, much of short-term memory capacity is expended on attention to isolated attributes and facts. As schemas become more complex chunks of interconnected information become unitized allowing for greater flexibility of instruction. The teacher can facilitate that process by identifying the key anchoring concepts, the central steps in a process, the classic experiment, the turning-point historical event, the most concrete instance of a principle, or the clearest demonstration of a performance as a starting point. Through a process of focusing on the central learning task, eliminating and reducing distraction, and using graphic and concrete organizers, new information can be effectively built into growing schemas.

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Children's New Universal Language: Its Alphabet Starts with "Mario Bros" ™

Alejandro Acuna Limon

Visual Literacy in children is a subject that has been investigated recently by educational researchers. Their interest is shown in different ways: applying it in the curriculum (Schamber, 1987), using it as a tool for art communication (Armstrong, 1981), and for interpreting and understanding media (Goldstone, 1989). As for cultural considerations, visual literacy is being related to people's background and cultural conventions (Mangan, 1978).

Another set of phenomena that could be related to visual literacy in children is in relation to videogames interaction and audiovisual media such as television. Videogames and T.V. are not just an influence on children, but an "integral" part of the youth culture (Gray, 1989).

The main purpose of this study is to make a comparison of visual literacy (the ability to interpret and create visual symbols) in children with different cultural background and language, with respect to videogames interaction practices and T.V. viewing habits. This paper presents the basic ideas of a descriptive study to be carried out among children from Brazil, México and the United States.

The findings presented are taken from a pilot testing of the instrument, applied in a city in Mexico.

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Background of Study

Visual Literacy

In a broad sense, the learned ability to interpret visual messages accurately and the ability to create such messages in the communication process is known as Visual Literacy. In other words, in comparision to traditional literacy, to "read" is the ability to understand and interpret visual symbols. "To write" in visual literacy is the ability to draw or create by other means (video, photography, etc.) those symbols in order to communicate efficiently. For the purpose of this study, we operationalized the concept of "Visual Literacy" to include not only interpreting visual symbols but creating them as well.

Other approaches to the concept have been reviewed by some researchers (Debes, 1970; Fransecky, 1969; Sinatra, 1981; Baca & Braden, 1990). To understand computer literacy, Stirebel (1985) discusses the potential definitions of visual and television literacies. Yet there is a need to relate visual literacy in children not only with formal education but with the components of their every day world; television, videogames, videos, computers, etc.

Television

Television and other audiovisual media effects on children have been studied exhaustively. Some studies reflect positive effects of television in children while other scientists have found negative ones (Schramm, 1979). Nevertheless, there is a huge gap in researchers' understanding of the effects of television on children.

Informal education through exposure to mass media possibly develops visual literacy in children. In modern times, almost a century after the first films were produced and 50 years after television was created, a 12-year-old city child may have seen two or three times more visual information than his/her parents and even ten or more times the quantity of his/her grandparents.

There are studies about the effects of viewing television that focus on social and psychological factors such as: violence (Dominick, 1984), socioeconomic status and family unit. Research about the relation between viewing television and school achievement is extensive. Williams (1982), synthesized the results of 23 different studies spanning the years 1954-1980, and found a median correlation (.06) between the amount of viewing and school achievement.

Television has been in homes all over the world for a long time and it will not disappear despite the efforts of groups like SET (Society for the Elimination of Television) or other civil groups like Action for Children's Television (ACT), created in 1968 and the NCCB, National Citizens Committee for Broadcasting, created in 1966, both with relative success in controlling advertising (Rebeil, 1987). Nevertheless, according to Gray (1989), efforts to control television programming will continue to fail until educators understand that television is an integral part of the youth culture, not just an influence.

Videogames

Unlike television, research about

videogames and its effects on children is new. The videogames industry has been dramatically growing since the first product in 1972 ("Pong" by Atari®); by 1980, 86 percent of the U.S. population between ages of 13 and 20 had played videogames (Trachman, 1981); by 1982, 9.7 billion dollars was spent in electronic arcades and home playing equipment (Alperowichz, 1983),with ten million people owning videgames units. By the end of 1991, there were 26 million homes with Nintendo® equipment (Semana, 1991). As for the Latin American countries, sales of videogames have been growing fast. Crowded electronic arcades are common place in the commercial areas in cities like Sao Paulo, México City, and Buenos Aires.

Several critics have claimed that videogames glorify violence and encourage antisocial behavior (New York Times, August, 1982). Nevertheless there is not clear scientific evidence of either negative or positive effects of video games on children (Selnow,1984).

Research about the effects of videogames on children has been scarce. Selnow (1984) concluded that the children in his study (ages 10-14) played videogames in arcades for some of the same reasons they watched television: 1) escape; 2) a sense of personal involvement in the action; and 3) a source of or substitute for companionship. Another researcher concluded that video game playing is neither the menace critics portray it to be, nor without possible negative consequences (Dominick, 1984). On the other hand, there are some researchers who have indicated that videogames are useful tools in teaching perceptual and motor skills (Jones & Kennedy, 1981; Driskell & Dwyer, 1984).

Visuals and Education

All language is a cultural convention. From the use of rudimentary sign language to sophisticated computer languages, there has to be agreement among groups about the meanings of symbols. Visual symbols are more easily associated with the referent than are verbal symbols (spoken words).

The main function of the visual symbols as a tool for communication, is to serve as a more concrete and faster way of obtaining the real meaning of the referent. In contrast, verbal symbols can be interpreted in many ways and the interpretation takes more effort. Also more background about the verbal symbols is needed in order to comunicate effectively. Words, as arbitrary symbols, do not look much like the thing they represent. Visuals, however, are iconic. That is, they normally resemble the thing they represent. As such, they serve as concrete clues to meaning (Heinich, Molenda & Russel, 1982).

In the educational field, visuals have an important function. From the time that the Greeks used sticks to draw in the sand to the modern use of computers to create virtual experiences for people by stimulating their kinesthetic nature and making them " live" within a universe created by graphics, tools have been used to create visual symbols and teach. Visual materials are used for two purposes: First, through the "decoding" process acting on the visual symbols to retrieve the meaning. Second, with the "encoding" process that enables students to create visuals to communicate effectively.

Universal Language

Everyone knows the importance of being verbally literate; nevertheless, in modern times, visual literacy is also important because many things change daily. The instructions of many products, the posting of signs in airports and touristic places and road signs, for example, are becoming more visual and less verbal. We can say that a universal code based upon visual symbols is currently being created. Schamber (1987) addresses the proliferation of visual symbols in contemporary communications and the need to set a visual literacy standard.

Cultural differences in perception are more subtle and numerous than educators suspect , as Mangan (1978) said.There is also a proliferation of words, symbols and figures suchas in Atari®,Nintendo®, Mario Bros™,The Simpsons, etc. that are currently a common standard in the every day life of children from the United States. They are also used commonly by many children with different cultural backgrounds and languages from almost any part of the world.

Before trying to set a standard for a global visual literacy, it is important to explain in a descriptive level, the following questions: Which are the factors that give children skills and abilities to make them visually literate? Is there a direct relationship between visual literacy level in children and their exposure to T.V. and videogames? Is the proliferation of cross-cultural television and expansion of video markets creating a new universal language?

Instrument

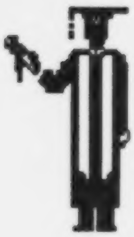
Description

In order to carry out the study that may answer the above questions, a five page questionnaire was created. The instrument is divided into three sections. First, a general section asks for name, age, sex and number of brothers and sisters. The second section is made up of open and closed ended questions and has the purpose of getting information about children's every day practices in relation to videogames interaction and television viewing. The first two questions ask about preferences, comparing T.V. and videogames with other activities that children participate in. The rest of the questions in this section ask for facts about variables we want to know; for example: How much money do you spend in arcades and in renting videogames a week? Which is your favorite television program? Another part in this section asks about the amount of television that is watched during weekday mornings, afternoons and evenings; the same questions are repeated for weekends.

This section has two control questions. One concenrs preferences and asks about an undesirable activity (washing dishes). If the child answers "I like to do it a lot" the questionnaire is discarded, to prevent bias by "social pressure". In the second control question children are asked to check as many videogames as they recognize and one of the items on the list is a nonexistant one. Questionnaries where this option has been checked should also be discarded.

The third section measure the visual

literacy level by adding two elements. First, the ability to recognize visual symbols in an accurate way is assessed. Examples are:



( )

1.-APRENDIZ
2.-MUCHACHO
3.-CULTURA
4.-BELLEZA
5.-MUSICO

1.-PLUMAS
2.-PAZ
3.-DESCANSO
4.-CIELO
5.-AIRE

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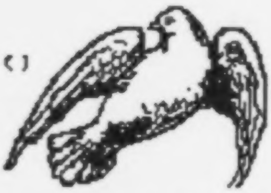
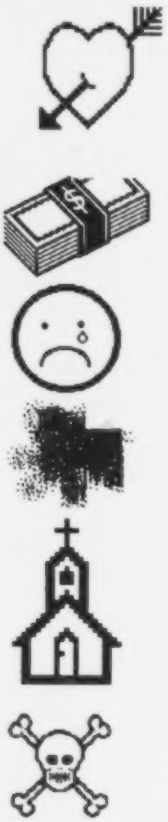


In order to measure recognition of visual symbols, we place a group of known and unknown visual symbols on one side. On the other we list verbal concepts and we ask to relate them. Some examples from the instrument's Spanish version are:



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1.-RELIGION
2.-PELIGRO
3.-DOLOR
4.-AMOR
5.-COHETE
6.-TIEMPO
7.-ESPACIO
8.-HAMBRE
9.-RIQUEZA

The second element that we take into consideration to get a score of visual literacy is the ability to draw visuals from abstract verbal concepts. To do so, the final page asks children to draw representations of the concepts "Friendship, "Violence", and "Happiness". A blank space that allows children to draw, is provided.

Translation and Adaptation

The original questionnarie was developed in Spanish and applied in a pilot study in order to test its reliability and internal validity. Then some changes were made. The translations in Portuguese and English are being made by experts in each language.

After a pilot study, with a small sample, using each translation of the instrument, the final adaptation should share the same validity and reliability as the original.

Study Design

Sample

In order to control external validity, the samples for each country are going to be drawn from cosmopolitan cities including, Mexico city, Sao Paulo in Brazil, New York in the United States. Subjects wili be randomly selected from a cluster sample. The study will consist of aproximately 720 children, aged 10-12.

Gender in the sample is expected to be proportional. Socioeconomic level will be determinted by school attendance. Samples should be selected within the urban areas of the cities selected, with a total of 240 children per city. Time of the instrument's application should not take more than 45 minutes.

Research Methods

Some descriptive as well as formative findings are expected from this study. With the data for the first section, we will make a scale to determine children' s range of time spent watching T.V. and playing video games with three groups; a) heavy players/watchers, b) moderate players/watchers and c) low players/watchers. More first hand informative data such as preferences in leisure time and favorite television programs are also expected.

For statistical analysis, after data collection, the mean, the standard deviation and other descriptive statistics will be displayed by using the SPSS program.

A correlation program will be used taking a composite rate calculated with the amount of T.V. watching plus the amount of interaction with videogames and correlated with the level of visual literacy abilities.

Partial Findings

The Spanish version of the questionnaire was pilot tested in a sample of children ages 10 - 13 in the city of Puebla, Mexico (1.2 million people). Groups of approximately 30 children were randomly selected from a list of schools: 2 schools were private (high socioeconomic level) and 2 more were selected from a list of state schools (low socioeconomic level).

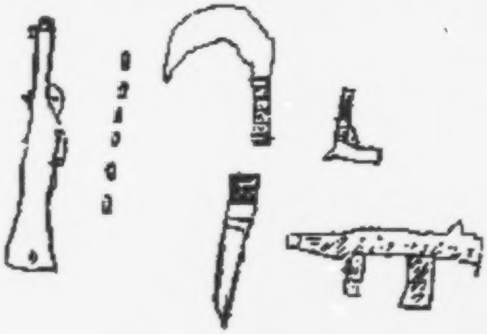
From a total of 112 questionnaires applied, 16 were discarded, so we worked with a sample size n=96. The following results were found:

The overall mean of time spent watching T.V. was 29.25 hours per week. Boys seem to be heavier T.V. watchers (33 h/w) than girls (26h/w).

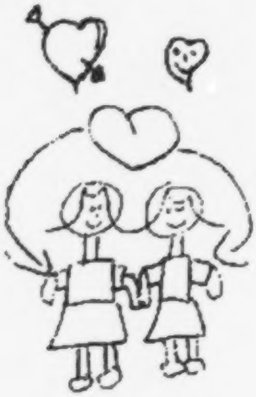
In respect to knowledge and time spent in videogames, boys scored as slightly heavier players (6.44) than girls (5.88) from a maximum of 8, without significant differences between socioeconomic levels.

Concerning the ability to recognize and draw visual symbols, there were no differences between the groups whose high overall score was 6.76 out of a maximum of 8. This result and the Kendall's T=1.56 created the need to change the section of the questionnaire that measured these abilities because the results were not reliable.

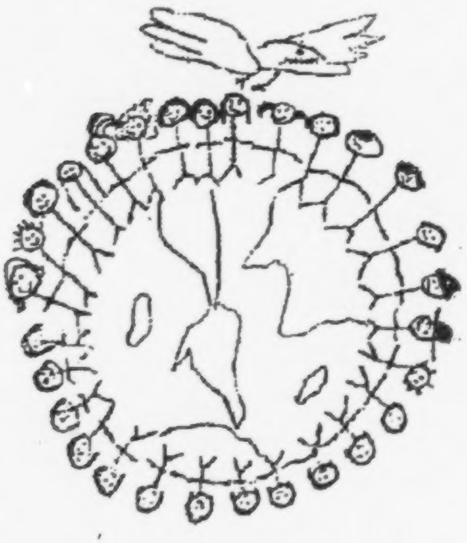
From the last part of the questionnaire, drawing of visual symbols which represented violence, some kind of weapon was found in more than 80% of the cases as the following examples:



In reference to the concepts of "friendship" and "happiness", drawings were created ranging from conventional symbols (hearts, smiling faces and Christmas trees) to more elaborated drawings of families and weddings. Some examples are:



A 12 year old girl made the following drawing representing "happiness":



Summary

The growing videogames' industry and the role of television as an integral part of homes all over the world place children in an environment quite different than their parents had. This phenomenon should be explained in relation to a new kind of need for the ability to interpret visual symbols and create them, that is known as visual literacy.

This paper presents the fundamentals for a study intended to explain visual literacy in children with different cultural backgrounds and languages with respect to videogame interaction practices and T.V. viewing habits.

The study is planned to be carried out in cosmopolitan cities from North and South America such as México City, Sao Paulo and New York. Results for the application of the test in a pilot study in Mexico are presented.

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Visual Literacy Education Developing Thinking Citizens Across Cultures

Marilyn J. Bazeli

Visual Literacy can be defined as the ability to interpret and process a visual message, and to understand and appreciate the content of the visual. In our visual world, visual literacy instruction seems to be a necessary part of the learning activities in schools. Further, the notion that visual literacy skills promote thinking skills, which could have implications into cognitive development, provides an even more crucial need for visual literacy instruction in schools, if it could be shown that such instruction does, indeed, improve measured cognitive ability of students. A brief review of literature regarding visual literacy, critical thinking skills, and cognitive ability will be given. Next, a research study will be presented which was designed to determine the effects of visual literacy instruction upon the measured cognitive ability of fourth- and fifth-grade students.

Review of Literature

Many studies have been conducted regarding spatial visualization and thinking skills. Russell and Bologna (1982) wrote that Tangram activities can improve students' geometry skills. They believe that Tangrams provide a necessary active visual approach to mathematics, developing critical viewing skills in relation to the most neglected area of the elementary school mathematics curriculum, namely geometry. Fennema and Tartre (1985) investigated the use of spatial visualization skills in solving word problems and fraction problems in math classes. Their study involved a three-year, longitudinal investigation into how girls and boys who had discrepant scores in spatial and verbal performance used spatial visualization skills in solving word problems and fraction problems. Students were interviewed annually in grades 6, 7, and 8. Each student was asked to read a problem, draw a picture to help solve it, solve it, and then explain how the picture was used in the solution. It was inferred in this study that a higher level of spatial visualization skill would aid students in achieving higher success at solving word problems.

Hendrickson (1988) wrote that visual training, involving such aspects as visual comparison of size, shape directionality, and solidity, along with visual memory and visual projection, would help students in spelling. He stated that as a child learns to visualize, "he learns to look and observe, to see, listen and know more...he learns symbol manipulation as visual activity which produces a good writer, good reader, and good speller" (Hendrickson, 1988, p. 394).

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A study by Boger (1952) investigated the effects of perceptual training on group I.Q. scores of elementary pupils in rural schools. The training consisted of a daily class exercise (5 to 15 minutes long), and jigsaw puzzles worked on individually by the students. The class exercises were to provide practice in following directions, noting details, perceiving spatial relationships, detecting likenesses and differences, and developing increased coordination of hand and eye movements. The Otis Quick Scoring Mental Ability Test and the California Test of Mental Maturity were administered as pretests and posttests to the control and experimental groups. The study showed that the perceptual training received by the experimental groups produced significant increase in their I.Q. scores and non-language scores (significant at the .01 level), with gains of subtest scores in spatial relationships, logical reasoning, and numerical reasoning also significant. Tests given five months later showed that gains made by the experimental groups were maintained.

Lowenfeld and Brittain (1982) wrote that art is considered "a fundamental catalyst in the thinking process and development of cognitive ability in children" (Lowenfeld & Brittain, 1982, p. 54). Rudolf Arnheim (1986) believes that thinking is perception, and stressed the correlation between "what there is to see and what there is to know" (Arnheim, 1986, p. 239).

Aust and Harrington (1988) stated that visual intelligence could extend beyond the processes required on an I.Q. test to include the abstract processes noted thinkers use. In other words, visual intelligence could promote increased cognitive ability in general.

Ragan (1988) stated that intelligence measures, or measures of ability, must involve visual perception, at least in some part. He has suggested that education should provide advanced perceptual development, and thus advanced cognitive development as well, and has called for research dealing with the development of perceptual skills and the relationship of those skills to the general cognitive development of children.

Research Study Presentation

The study reported here investigated the effects of visual literacy instruction upon the measured cognitive ability of fourth- and fifth-grade students. Visuals familiar to students in our world today, such as television, computers, overhead transparencies, puzzles, manipulatives, etc., were incorporated into the instruction. Metacognition was stressed in all lessons, encouraging students to verbalize their thinking process.

Participants in this quasi-experimental research study were from four intact classes in an elementary school in a rural, middle-class community fifty miles west of Chicago. Forty-seven students in the control groups received no special instruction in visual literacy. Fifty students in the experimental group received special instruction in visual literacy for one hour and 45 minutes each week, with additional individual activities totaling approximately one hour per week, for a period of six weeks.

The special instruction in visual literacy consisted of a 35-minute instructional period three times a week. For the first 20 minutes, the students participated in teacher-led discussions involving the use of visual technology or techniques, such as television, pictures, manipulatives, transparencies, modeling, or role-playing. For the remaining 15 minutes, students engaged in small-group or individual activities, such as Tangrams, Pentominoes, categorizing, or reading pictures, furthering and enhancing the concept discussed with the teacher. Students additionally practiced visual literacy skills while utilizing specific computer programs for approximately an hour per week. Specific thinking skills addressed in the lessons were: analysis, sequence, attribute identification, categorizing, patterns, analogies, comparison, figural series, inference and logic, perception and memory of visuals.

Cognitive ability was measured by means of a pretest and a posttest. The Otis-Lennon School Ability Test, Level E, was administered to all students in the sample to obtain a level of cognitive ability for each student at the beginning of the study. Each student filled out a questionnaire regarding his/her attitude toward the critical thinking required in test items. After the six-week instructional period, the OLSAT was again administered to all students in the sample to obtain a measurement of growth in cognitive ability. Additionally, students responded to another questionnaire regarding their attitude toward the type of thinking utilized during the test.

At the end of the instructional period, the data were organized and analyzed. The hypotheses were analyzed using the statistical procedure of analysis of variance (ANOVA). The results showed that there was significant improvement in the cognitive ability scores of students in the experimental group, but that there was also a significant improvement in the cognitive ability scores of students in the control group. There was no significant difference between the means of the experimental and control group posttest scores. There was no significant difference between the means of the posttest scores of the groups when analyzed by gender, by ability, or by both gender and ability. However, there appeared to be a more positive attitude toward critical thinking among the students in the experimental group than in the control group. This could be interpreted to mean that the students receiving instruction in visual literacy did approach the critical thinking tasks presented on the OLSAT test with a more positive, confident, and motivated feeling.

Recommendations for Further Research

The following are offered as recommendations for further research into links between visual literacy instruction and increased cognitive ability:

1. The OLSAT could be used in combination with a test designed to test purely visual thinking. Additionally, students could be tested to determine if, after instruction, they had become better viewers, better critical thinkers about visuals, or more informed about visuals.

2. A study involving a longer instruction period is recommended, at least one semester in length. Students need time to experiment with, analyze, and apply the thinking strategies they learn in individual activities.

3. Teachers should be trained in the use of visual literacy skills before the beginning of the instructional period. The ties between critical viewing and critical thinking need to be made stronger, with more integration and application

of visual thinking skills into all areas of the curriculum.

4. Teachers should be monitored to make certain that the instruction in the control and experimental groups proceeds exactly as outlined in the instructional design.

5. Further research studies should be conducted in a neutral setting, where the investigator is not known. That would eliminate loyalty to the investigator, which was a factor in this study. (Control group students and teachers in this study were reported to be extremely motivated because they wanted to help the investigator.)

6. The attitude of students toward critical thinking skills after engaging in the visual activities implemented in this study bears further investigation. The activities used in this study were very much enjoyed by students, and students enthusiastically involved themselves in the challenges offered by the visual puzzles. Making thinking fun is an area worth investigating.

7. It was noted that the experimental group scored more correctly than the control group on 67% of the items in the Figural Reasoning category. Further study into this phenomenon ought to be conducted.

8. A future study could be improved by the use of a larger number of students in the research sample. A sample drawn from several schools in varying communities also might show differences not found in a sample drawn from a single school.

Summary

We live in a highly visual world, with visual technologies becoming more and more prevalent. The form of communication in the world has become increasingly visual. As communication methods change, methods of analyzing must change. Thus, visual literacy education in schools may be helpful in developing thinking citizens across cultures, equipped to deal with present and future visual communications. The visual channel is independent of language barriers; therefore, educators need to focus more attention on that channel for instruction in all areas of the curriculum. Most of the instructional materials and methods used in classrooms today center upon printed material, with highly verbal requirements for success. Visuals have often simply been used to support textbooks or other verbal materials. If educators can retrain themselves to focus on visual literacy skills, including critical viewing, then critical thinking and cognitive development may also be enhanced. This study did not find a link between visual literacy instruction and increased cognitive development; however, attitudes of students toward problem solving and critical thinking appeared to improve after instruction. That in itself is of importance to educators. Developing a positive approach to thinking is of utmost importance in education. Teaching students to think about how they think and to develop critical thinking skills, especially in relation to visual communications, are skills that seem very necessary for the 21st century.

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Microcomputers and Development of Visual Literacy: Effects of Logo Tessellations

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The use of computers in education often brings to mind the ability to develop higher-order thinking and to teach in a visual way rather than a text-based way. Yet, the content of many computer-based lessons and their accompanying images on the screen often neglect this potential mode of teaching. This paper reports a study that investigated the potential of the Logo programming language to develop visual literacy skill in elementary school students.

Purpose

The purpose of this research was to investigate the potential of a Logo environment to develop visual literacy and recognition of Escher-type geometric constructions within second grade and sixth grade students. Specifically, the following questions were asked. Can students use higher-order and creative thinking skills in relation to using computers to create mathematical tessellations and art? Can students create Escher-like tessellations using Logo? Does this enhance their visual literacy and visual perception? Can students transfer that knowledge when looking at the prints of M.C. Escher and describe the more obvious figures and the underlying geometrical shapes within Escher's prints?

Background

Through the cognitive and organizational processes of thinking, one develops literacy in the visual and verbal domains. "Visual literacy is the active reconstruction of past visual experience with incoming visual messages to obtain meaning" (Sinatra, 1986, p. 5). Visual information is sent to the brain where it is interpreted and modified in light of past experiences. This process begins early in life and precedes or develops concurrently with oral literacy (Sinatra, 1986).

Visual literacy is the ability to not only understand paintings, photographs, film, and other visual media, but also the ability to communicate or express oneself with at least one visual medium (Curtiss, 1987). It draws its meaning from the way one thinks visually, creates new knowledge, and uses thinking skills beyond those which are basic in the approach to learning. These skills often employ higher-order thinking which challenges the traditional path of problem solving and applies different approaches to learning. These different approaches call upon different learning styles as each situation demands.

Our visual awareness, which is how we see, and our visual perception, which is how we view objects of nature and their relationship to the space around them, help us to seek, uncover and construct new ideas. For centuries, nature and its objects have been viewed from the constructs of Galileo's "geometricizing physics" (Jones, 1989, p. 8). Within this construct nature is perceived solely in terms of its geometrical patterns and mathematical physics. Geometry, for example, has provided a systematic method of understanding shapes and their transformation within space.

To have an understanding of shapes within space is a "perceptual consciousness" (Jones, 1989, p. 124). An awareness of spatiality is vital and important in creating new knowledge. Just as nature has been defined for centuries by scientists and mathematicians, so too have artists visualized objects in space through their paintings, sculptures, and other media. They discover space through artistic expression rather than mathematical induction.

But artists and mathematicians rarely mix their discoveries. As forms of expression, the arts and mathematics have not been assimilated by artists or scientists. This is often due to the unwritten doctrine that artists should not practice intellectuality in their work (Locher, 1988).

Escher, however, combined the ideas of the empirical world as an illusion with mathematical representations of that world. The mathematics represented the unifying principle upon which a work was constructed and arranged (Thornburg, 1983). Escher's prints conveyed his ability to balance perfect forms and structures with the idea that everything is simply an illusion (Locher, 1988). These artistic renderings of illusory geometric shapes rotating about a point in space generate a mathematical beauty which has the ability to please the senses and elate the mind of the viewer.

Viewing Escher's works, appreciating Escher's vision and mathematical ideas, and being able to describe what is visually present requires conceptual thinking. Arnheim (1974) describes this form of reasoning as an artistic activity and claims that the process calls upon perception and thought which are intertwined in an indivisible manner. He posits that our senses employ impressions and experiences from which we form perceptions, which we then express through our thoughts. Arnheim indicates three elements that are necessary for human cognition: common characteristics that control perception in the nervous system and its reflections upon consciousness; constructing physical reality through the senses; and the properties inherent in media through which cognitive experiences take place (Arnheim, 1986). This process of visual conception is formed by one's intent, creative resourcefulness, and fresh ideas (Curtiss, 1987). Through this process of visual thinking we are able to evaluate our visual experiences and make visual statements regarding our perceptions.

Being visually literate is tantamount to being educationally well-rounded as a person. This premise has major implications for educators and the curriculum. According to Arnheim (1986), visual thinking promotes a continuous link between pictures and words, and between the arts and sciences. These links extend more broadly to encompass both language and images, as well as perceptual experience and theoretical reasoning. And because the structural properties of images, symmetry for example, drive the thinking, Arnheim advocates that teachers use specific rules related to pictorial composition and visual order when presenting new geometry concepts to students. Thus, students will be encouraged to think in terms of visual images.

Visual thinking as a primary medium of thought can be defined as having three components which include perceptual images, mental images, and graphic images (Erikkson,1988). Perceptual images are the ways we choose to see and interpret the external world. Mental images are the ways we invent, envision, create ideas to solve problems and integrate information. Graphic images are the visual codes and languages we use to communicate information.

According to Eriksson (1988), the visual nature of communication and the fact that visual images are the building blocks of data require a new language based upon verbal-visual cues. This requires educators and curriculum designers to emphasize visual literacy skills.

The computer has the potential to offer instruction based upon visualization. For example, images created on the computer screen can enhance the meaning of lessons. In addition particular software which is based upon visualization may have the potential of helping students develop visual literacy skills. For example, Logo uses visual elements which show students the results of structured procedures that they write. Knupfer (1991) recently reported some interesting patterns of increasing cognitive skill related to spatial scanning among students who used Logo during group activity. This research investigates the possibility that using Logo will help students develop visual literacy skills and spatial scanning as it relates to Escher-like tessellations.

Method

Subjects

Four classes of students participated in this study: two classes of second grade students and two classes of sixth grade students, totalling 110 students. All classes were heterogeneously mixed. One teacher instructed both second-grade classes and another teacher instructed both sixth-grade classes. None of the second graders had experience with Logo prior to this study, and approximately half of the sixth graders had been exposed to Logo during the previous school year.

A control group of 126 students was used; again, there were two classes of second-grade students and two classes of sixth-grade students. The control group was from a different school within the same geographical region and consisted of a similar population of students.

Materials

Pretest and Posttest. A pretest and posttest were conducted using Escher prints. Two prints were used for the pretest and two different prints, which had similar qualities in terms of this study, were used for the posttest. All prints had one or two figures and one geometric shape upon which the print was constructed. The pretest and the posttest each contained two colored prints along with one black and white print.

Software. LogoWriter (LCSI) was used as the software with which students practiced creating and tessellating shapes. The students created all geometric shapes, patterns, and tessellations within this software environment with the exception of one paper and pencil exercise that served as an introduction to the concept of tessellations. Use of the Logo language allowed the students to work within a microworld as Papert envisioned.

Escher Artwork. Samples of Escher artwork were displayed in the computer laboratory where the students had their classes. Also, a few books on Escher were placed within the school library for the students to check out.

Paper and Felt-tip Pens. One class period called for the introduction of tessellations using a paper-based activity in which the students created tessellations and colored patterns within them.

Procedure

This study was conducted during an entire spring semester; students used computers in a laboratory setting for one 40-minute session during each week. Most of the students worked in preassigned pairs. Students were individually pretested using two Escher prints. They were asked to describe the recognizable figures and geometric shapes that they saw in the prints.

Next, the students received instruction in creating shapes using the LogoWriter software. They were taught commands to first create the shape and then to write a procedure for constructing the shape. Initially, shapes were limited to squares, triangles, and hexagons so that students could tessellate their work. Once students mastered writing procedures, they were taught the MOVE command and practiced tiling their shapes vertically or horizontally on the screen. Finally, students were asked to tessellate their shapes and fill the screen with the tessellations.

In according with research on transfer of knowledge, once the foundations were laid, the students were given instruction on Escher prints and the Escher style of creating tessellations. Approximately twelve weeks into the study, one researcher taught a lesson to familiarize the students with Escher and the concept of tessellations within artwork. During a single class period, the students were shown examples of Escher artwork and were able to look for the figures and geometric shapes within it. After hearing the presentation and seeing some examples, the students were able to try creating a tessellation by drawing a plan on a piece of paper. Ideally, they would then try to create that plan on the computer.

The students continued to practice tessellating their shapes, printed the full-screen tessellations on paper, and drew Escher-like figures on their printouts with colorful felt-tip pens. Finally, the students were posttested using two additional Escher prints that they had not seen before. The posttest followed the same method as the pretest and the only variable was fresh prints to avoid the recognition of previous viewings. The control group received no Logo instruction and were simply given the pretest and posttest.

Analysis

This research was analyzed using qualitative methodology. The analysis, which follows, allowed some conclusions to be drawn about the feasibility of using Logo to enhance visual literacy and spatial scanning skills which might transfer to the ability to recognize Escher-type geometric patterns.

Teaching Style. The second-grade students were taught by one second-grade teacher who had previously worked as a computer lab teacher. The sixth-graders were taught by the current computer lab instructor. Both instructors were knowledgable in the use of computers and LogoWriter. Their approaches to teaching with computers were similar, but their teaching styles were not. The second-grade teacher's style was gregarious, animated, and experientially oriented while the sixth-grade teacher's style was structured, linear, and oriented toward rote learning.

Prior to beginning the Logo instruction, both teachers were given a script to guide them through the weekly lessons. The second-grade teacher began by following the script but changed the script in consultation with the researchers when he felt the students needed more time to work on understanding particular concepts, such as how to make the turtle move or the meaning of tessellation. The sixth-grade teacher followed his own course of study with the unit and ignored the script from the beginning.

Moving the Turtle and Creating a Square. The objective of the beginning lessons was to allow the students to explore and become familiar with moving the turtle around on the screen. Then the students were to create a procedure which drew a square.

Second-grade students were excited about making the turtle move on the screen and the teacher began by discussing the terms FORWARD, BACKWARD, RIGHT and LEFT. He also showed the students procedures in which the terms were abbreviated and not abbreviated. In succeeding lessons he introduced them to writing procedures on the "flip" side of the LogoWriter page. Some students worked in this format and seemed comfortable while others were lost. The teacher realized that a number of students were not successful and eventually told the class the procedure for making a square. At this point, he also expressed to the researchers his frustration with time constraints of the computer lab schedule.

Sixth-grade students experienced a different approach to the lesson. The teacher allowed little time for students to explore the movement of the turtle in creating designs and most students typed commands such as FORWARD 5000 which filled the screen with lines. The teacher did not seem concerned that most students were not on task. He simply told them the procedure for drawing a square but did not challenge them to either discover it or to show understanding of what made it work.

Tessellating and Tiling the Square. With the square procedure, students were to tessellate and rotate the square to form a "window" which was divided into four quadrants. Students were free to explore ways of accomplishing the task. For example, one pair of second-grade students used the FORWARD AND BACKWARD commands to create the window while another pair succeeded in building the window by exploring with the RIGHT AND LEFT commands. The sixth graders were provided with the procedure on their scrapbook disks, so there was little exploration on their part.

Following the "window" activity, students were to tile the square in either rows or columns across the screen. This was a precursor to creating more rows or columns to fill the screen with tessellating squares. Once a square was used for tiling, the students were free to try a triangle or hexagon shape and then to go on to explore with other shapes.

Second-grade students struggled with trying to make the square tile across the page. When the teacher felt the frustration level was too high, he changed the objectives. He created shapes on the shapes page in the LogoWriter scrapbook and then copied those shapes onto the scrapbook disks of the students. He showed the students how to go to the shapes page and find a particular shape using the SET SHAPE command. Next, the teacher showed the students how to cover the page with the selected shape by using the SHADE command. Finally, he showed the students how to change and recreate shapes on the shapes page.

The students were directed to explore choosing a shape and shading the page with the chosen shape. In the next two lessons, they were given instructions to shade their screens with the shape that corresponded to the number label on their computer stations and to decide whether the shape truly tessellated. The students then looked at surrounding computer stations in the room and tried to decide which screens contained tessellating shapes. The majority of students recognized whether a shape tessellated or not. They also seemed less frustrated with this activity.

Among the sixth graders, various strategies were used to accomplish the task. For example, one pair of the sixth graders flipped the page to create a series of procedures to make the row of squares. The procedures involved creating the square, moving it, drawing it again, and so on until the square filled a row. Another pair of sixth graders did not flip the page, but instead worked in the active command mode. In addition, they acted out the movements while planning the computer commands. One of the students acted as the turtle and moved in the direction they wanted the turtle to move while the other student typed in the procedure.

Not all sixth-grade students were as successful. Some students were confused and were not sure how to make the turtle move where they wanted it to be placed. Students who were used to executing procedures only from the middle of the screen were likely to experience some difficulty with initial placement of the turtle for their tiling and tessellating procedures.

Another sixth-grade pair changed the shape of the turtle to a bunny and were trying to tessellate their square. Because the bunny-figure would not rotate like the turtle, they were having a difficult time visualizing which direction the bunny was headed. One researcher suggested that the students think about the turtle being underneath their bunny shape.

In this way, they could imagine what the turtle would do. The students then seemed to be more successful, possibly because they concentrated on the commands to tessellate the figure rather than simply observing the shape on the screen.

Adding to the Challenge. Even though the second graders learned how to fill a computer screen with a chosen shape, they did not create tessellations from scratch using the computer. Instead, second-grade students were introduced to the artist M. C. Escher and created tessellations on paper. The second graders worked in groups of four during this activity and they created some successful tessellations on paper.

When the sixth-grade students had developed an understanding of tessellating a square, they were introduced to the coordinate system, the SHOW POSITION command, and the SET POSITION command. They were asked to try writing coordinates into their procedures. Approximately one-third of the students used this method of moving the turtle to a particular place on the screen. The majority of students continued in the previous manner.

The final three weeks of the unit were devoted to sixth-grade students writing procedures which pushed in and pulled out the sides of a square as part of the process of creating Escher-like shapes. Figure 1 shows an example of this type of work. The shape stands alone as it was created and then it is incorporated in a tessellating pattern. Students who were able to create more complicated patterns went on to design fancier tessellations like the one pictured in Figure 2.

Student Attitudes. Throughout the study the students remained interested in the daily tasks. The second-graders experienced some frustration, but because the teacher was alert to its signs, adjustments were made to the lessons which allowed students to proceed at a more comfortable level. The sixth graders demonstrated various levels of enthusiasm. Some students worked ardently, while others did not remain on task.

Once the students began to be successful with the tessellations, their interest level increased; this was true of both grade levels. After the lesson on Escher and his artwork, the students showed a remarkable interest in the activity. Some second graders were heard to remark that they were going to "play artist" after school and some of the sixth graders checked out books on Escher from the library. Students at both grade levels wanted to know where they could find other things by Escher. For example, the researcher had shown the students a tote bag, some wrapping paper, and some posters contained Escher prints, and the students wanted to buy some of those things for themselves. They were also interested in finding more books about Escher at the public library.

Results and Conclusions

During the pretest, most of the students at both grade levels were able to see some figures in the Escher prints, but none of them were able to identify the underlying geometric shape that the artwork was built upon. A few of the students were not able to see figures either. A couple of rare students exhibited a seemingly reverse capability by being able to see the underlying

Figure 1
Shape and Tessellation of a Pushed In and Pulled Out Square

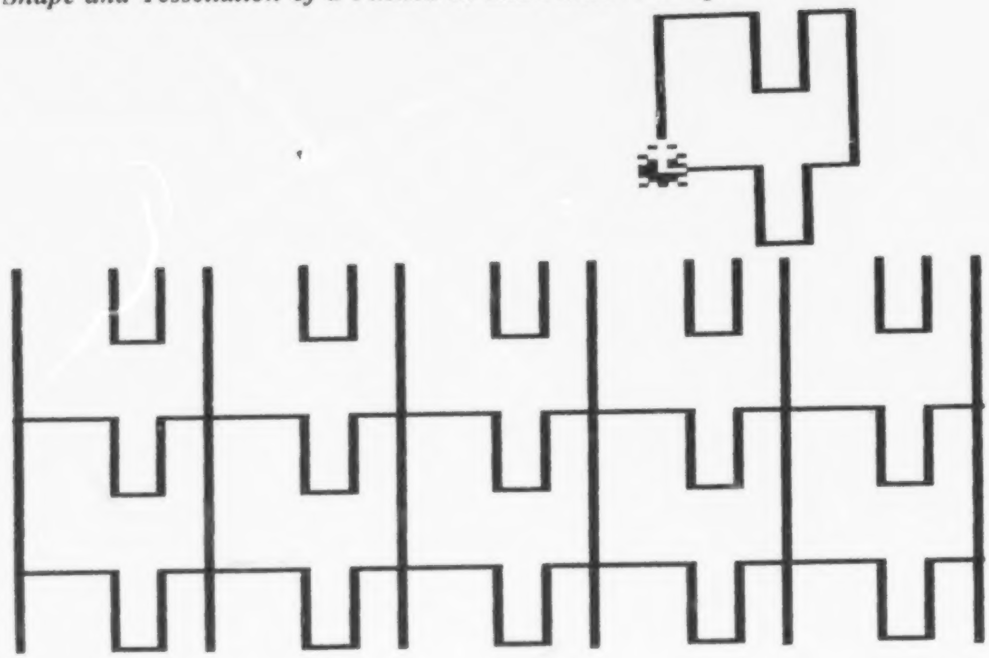
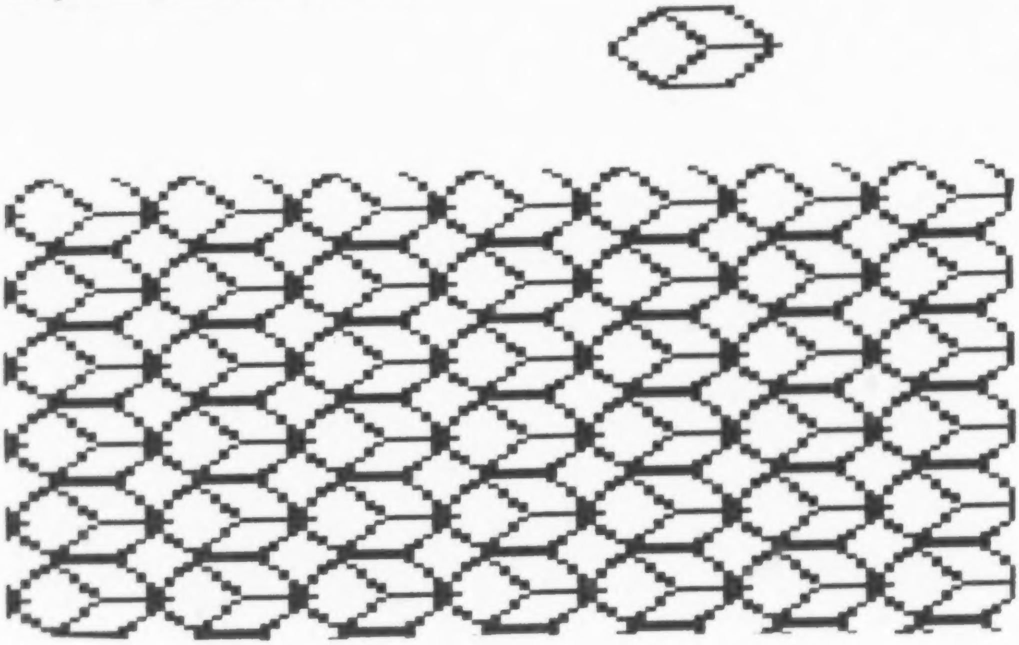


Figure 2
Shape and Tessellation of a Cube



geometric pattern while they were not able to see the figures within the pictures.

After the Logo unit, the researchers believed that most sixth graders would be able to recognize more figures and shapes on the posttest, but had doubts about the ability of the second graders to do any better than they had on the pretest. This did not turn out to be the case. Virtually all of the students in the study were able to see the figures on the posttest and a large majority of both grades were able to see the underlying geometric patterns within the artwork. The students in the control group showed the same results on the posttest as they had on the pretest for both grade levels.

Based upon the observed performance and attitude of the students along with the changes in their ability to see geometric constructions within a piece of artwork, it appears that using Logo can be helpful in promoting visual-spatial awareness. Even though the second graders did not create tessellations from scratch on the computer, they did get the experience of creating the tessellations with the shapes page and the SHADE command. They also were able to view the computer screens of their peers to discuss which ones tessellated and which ones did not. Even these young students were able to improve their performance on the posttest.

Students in this study seemed to have a positive attitude about this unit. While some students struggled with the assignments and were not able to complete the on-screen tessellations, others created Escher-like designs, thus accomplishing the overall objectives of the unit.

Although schools tend to focus on activities that use left brain or language processes more than right brain processes, many students do function very well, or even better, using the artistic element promoted by the right side of the brain. If Logo is valuable in aiding development of visual literacy, then it certainly can benefit students at the lower and upper elementary grade levels.

Further research should be conducted using this study as a pilot test. Such research would be most helpful if it encompassed a longer period of time for the activities in the unit, particularly at the second-grade level. The second graders probably need a full school year to accomplish the objective of learning to tessellate figures from scratch within the Logo language. A longitudinal study might also include the question of how the combination of computers and art over time affects students attitudes toward the visual arts.

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The Effects of Computer-Generated Animation on Student Achievement of Different Types of Educational Objectives

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Francis M. Dwyer

The purpose of this research study was to examine the effects of computer-generated implosion animation on student achievement of different types of educational objectives. The instructional content was designed to facilitate the utilization of visual techniques used in printed materials and computer graphics.

The results of the study indicate general improvement of student performance when a combination of print-based text materials and specific computer graphic animation techniques are used over a self-paced printed booklet with the static visual materials. However, performance on the different learning levels tested varied and was not consistent within the groups. This indicates that the treatments vary for the different educational objectives.

Study time and test time were recorded to make further post hoc assessment of instructional efficiency and effectiveness. Significant differences in the time study revealed that significantly more study time was expended by students in both computer groups.

Background

The use of microcomputers for education and training is increasing as the equipment and technological capabilities as a delivery resource become more affordable. The development of high level computer program authoring languages coupled with the development of expanded microcomputer technologies has increased the ease of use for the instructional software developer. Allowances for the incorporation of features of animation and realistic graphics on individual, stand-alone desktop computers are rapidly becoming part of the instructional designer's available development and delivery technology. Previously, these high quality, sophisticated animation features have been primarily reserved for film, television, interactive video and/or large system computers and required extensive specialized knowledge to fully utilize the technology.

The underscoring foundation for sound instructional courseware design using microcomputer delivery systems must be consistent and congruent with learning theory. The entertainment factors that may be associated with the increasing capabilities of instructional courseware development tools must be controlled to avoid negative effects.

The Need for the Study

Research on microcomputer use in education and training has proceeded rapidly in the past 25 years. This experimental research study was conducted specifically to assess the outcomes of the behavioral and cognitive strategies incorporated by the computer-based visual instruction.

Hannifan and Reiber (1989), in their development of ROPES+ classifies instructional strategies used in technologically oriented settings, conclude that:

> If we are to capitalize on the potential of the computer to create qualitatively and structurally different learning environments, then we must validate such alternatives and refine an understanding of both how and when they can be applied, (p. 112)

With a goal to foster learning by an educational activity, including educational technology, extensive examination of the psychological roots must be conducted (Winn, 1989).

Winn's (1989) "first principles" of descriptive theory for the instructional designer include drawing from experimental and nonexperimental resources. One of the nonexperimental resources include a "hit or miss" approach without much consideration of explanation or theory. This approach rarely produces optimally effective instruction. An example of this approach is the literal adoption of an existing teacher-delivered lesson plan into a computer-delivered environment. Clark (1985) emphasized that gain in student performance by a computer delivery system contribution is often confused with the redesign of instructional events to fit the software system. Therefore, effectiveness may be in the instructional redesign to match software limitations as opposed to the computer delivery system. This study is designed to separate specific strategic activities in a controlled design environment that will permit an increased transfer of new knowledge or the adoption of prior learning to meet specific objectives.

A report on visualization in *Computer Graphics* (McCormick, DeFanti, & Brown, 1987) addresses the issue for research of visual reasoning and graphic interpretation as meeting long-term goals in the following context:

> The field of visualization requires a new formulation of the problems of transforming symbolic and numerical descriptions into graphic renderings and simulated behaviors. . . New concepts are required that define human capabilities for analogical and metaphorical visualization, transformations of visually representable concepts, and generation of intuitive understandings. . . . Many modes of thought require concurrent processing of symbolic information and visual imagery. . . . Textbooks provide both text

> and supporting illustrations, enabling us to reference either or both for better comprehension. The concurrent processing of verbal and visual information will be of importance if computer-based intelligence systems are to capture any significant portion of the world's knowledge. (p. C-5)

The Statement of the Problem

The purpose of this study was to examine the specific effects of computer graphics and rehearsal strategies on student achievement on different educational objectives.

The hypotheses are as follows:

H_1 There will be insignificant differences in achievement among the students in the three treatment groups (programmed text booklet treatment group, computer-animated implosion treatment group, and the computer-animated implosion plus animated blood flow treatment group) on tests designed to measure different educational objectives.

H_2 There will be insignificant differences in Total Test Scores among students in the three study groups (programmed text booklet treatment group, computer-animated implosion treatment group, and the computer-animated implosion plus animated blood flow treatment group.)

H_3 There will be insignificant differences in the total instructional time among the three study groups (programmed text booklet treatment group, computer-animated implosion treatment group, and the computer-animated implosion plus animated blood flow treatment group.)

Limitations

The data obtained in this study are limited to spatial and factual recall and comprehension information. An immediate posttest assessment was used with post hoc analysis of the results. No pretest or delayed retention evaluations were made. The control group was the printed booklet group for assessment of the effects of the visual material strategies delivered by the microcomputer. The control group received printed static outline drawings in conjunction with the printed text. The two computer groups' visual graphics were limited to monochrome outline drawings. The computer animation was limited to arrows. Both computer group subjects interacted with the microcomputer by making simple keystrokes on the keyboard. All groups received the same printed text material. Since this study was conducted with college level students it is assumed that the data cannot be generalized to lower reading level subjects without adjustment to the verbal materials and further research.

REVIEW OF RELATED LITERATURE

Greek philosopher Aristotle and seventeenth-century philosopher Locke believed thought was composed of images originated in perceptions (Samuels & Samuels, 1975). While a great deal of research has explained the effects of visual cues and cognitive styles on information processing, the sophisticated development of technology and the availability of the technology to developers and the receivers of the instruction demand more attention to the effects of specific visual strategies used in and during the instructional event.

Visualization research has had to keep pace with new and innovative technologies. With the dawning of generally affordable micro-computer systems possessing expanded computer memory and high speed microprocessors (previously reserved only for larger mainframe systems), more evidence must be provided for sound incorporation of learning theory into computer-delivered instruction. The capability of these desktop systems to reproduce realistic graphics and simulations leads research to focus on effective and efficient learning designs that meet specific learning objectives.

Visualization as learning cues

Important conditions of learning require the student to actively interact responsively with the materials being presented. Gropper (1963) views non-verbal visualization to include graphics, pictorials, or demonstrational presentations. The use of visuals promotes acquisition, retention, and transfer of responses and further foster generalization of responses to new situations (Gropper, 1963).

Processing of information is effective when overstimulation of the senses is avoided. The control of sensory stimulus in an instructional design sequence improves stimulus response. The result is an increase of information processing. The increased processing (acquisition) of relevant information facilitates retention. Serverin (1967) concluded that a multichannel communication is more effective when relevant cues are used.

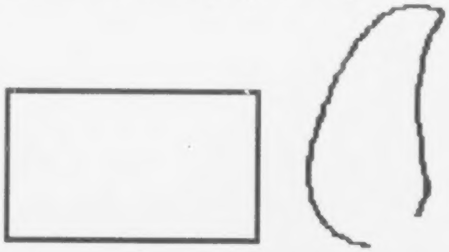
Enhancing the internal cognitive processing by external factors is an important instructional system design concern (Dwyer, 1978, 1987). Effective external conditions for factual materials include strategies that require learners to use a minimum of effort separating relevant from irrelevant information (abstraction) (Canelos, 1983). The information contained in visual illustrations range from the complex realistic representation to simple outline drawings. Opposing views of the theoretical field and research have long been entwined in controversy over the completeness of the number of cues needed for effective encoding to occur (Wise, 1984). Drawing upon a large mass of research evidence collected by Dwyer's Program of Systematic Evaluation, indicators show that overstimulation by additional visual cues (complex drawings or pictures) may inhibit achievement. An exception to cue impediment is when the student may already possess a highly developed set of cognitive skills that enables the acquisition of vital verbal information. Ausburn and Ausburn (1978) make the argument that a learner's manner of stimuli transformation prevents the completion of a learning task.

A study conducted by Bowen, Clark, Lesgold, and Winzenz (1968) focuses on the recall of long lists of items. Their study indicates that the hierarchical structure of related information, having built in cue systems, is most effective. The separation of clusters of information may be distinct and interrelated or distinct and different to a whole or larger cluster. Danserereau, Actinson, and Long (1974) found in their review and synthesis of the literature that poorer students tended to rely on low level strategies (i.e., rote learning) and fail to make a conceptual integration of new information to existing information making transfer virtually impossible.

The effect of visualization for facilitating learning is fundamentally ingrained in the integration of non-verbal visual communication and verbal communication that aids students in the acquisition, retention, recall, and transfer of responses (Gropper, 1963) Oftentimes a visual can communicate information that non-verbal materials alone cannot accomplish in an effective or efficient manner. Cognitive values for the inclusion of visual representations include strategy formation.

Animated implosion

Specific additional instructional strategies are used to aid learners to properly encode multiple irregular shapes and the orientation of the parts to a larger unit or whole. When graphic forms are of different, irregular shapes and are related to a larger unit or whole, there is an increase of effort to properly encode the information (Buffart, Leewenburg, & Restle, 1981). This difficulty is explained in part by the lack of form redundancy. As an example, a redundant shape such as a rectangle can be encoded as a line of specified orientation and length, with a second line of a different orientation and length, plus a repetition of the first two lines and orientation (Illustration 1). Visual complexity occurs when the occurrence of the line or lines lack repetition of orientation and length. An example of an irregular shape is found in the description of an object with interconnecting contours and curved surfaces (Kellman, & Shipley, 1991).



Rectangle Right Auricle

Illustration 1

Learner control of the repetitive occurrences (animation) of irregularly shaped objects moving in (imploding) on other previous irregular objects forces a particular way of organizing observed information. Parts or related objects remain individual part or objects, becoming combined as organized lower level objects within higher level objects. Gestalt psychologists declare that the whole is different from the sum of the parts (Koffka, 1935). Miller's (1956) discussion on the human observer's channel capacity defines objects with a lot of curvature as being apparently harder to judge. Channel capacity of the observer represents the upper end of the greatest amount of information that can be matched to the stimulus given. In his discussion, the number of seven repetitions of difficult information can increase the observers channel capacity. Reardon (1989) views instructional support design as devices that direct attention, provide cues, and give organizational assistance to the learner. Clustering of the information is one organizational strategy that has been proven to be effective for enhancement of recall.

Outline drawings

The ability of individuals to perceive surface edges is probably a consequence of continual encounters with spatial objects (Hockberg, 1962). Therefore the ability to distinguish shapes and the relationship to a larger complex picture can enable transfer with a minimum of effort.

In the learning environment, the relationship of verbal and visual information must be easily transferred as related information with prior existing information and as new information for later retrieval and use.

Visual impact on learning

The use of visuals to enhance learning must contain relevant content that compliments oral and printed instruction for a resultant gain in student achievement. Visuals compress information and illustrates salient parts of instructional presentations. However, the use of visuals is not without complexity when associated with instruction (Dwyer, 1978).

Each type of educational objective has associated with it characteristic problems (Gagné, 1965). A clear definition of the educational objectives and the learner will enable the instructional designer to make decisions about the amount of detail required in visually presented material. Dwyer (1978, p. 26) states "Simplification or precompression of information prior to presentation to learners increases their achievement of the content material." Complex visual information may impair performance if the student is expected to reproduce a visual or recognize an outline drawing. On the other hand, if an outline drawing (i.e., line drawing) is used for instructional purposes and recall is tested using realistic or shaded drawings, the learner's performance may suffer.

Appropriate visuals facilitate an additional benefit by providing learning guidance. The use of pictorial elaboration activates visual images and takes advantage of the superior retentivity of multiple encoding of information (Pavio, 1971). Pictures can act as cues for retrieval of what has been learned.

Time as an instructional variable

Time is clearly important in cognition. The instructional variable of time is one of many distinct assignments of value to educational objectives and related costs (Scandura, 1977). Optimization of instruction is realized when a balance is formed in the educational value gained associated with the instruction delivery and total cost (money). Time enters in the instructional design equation as a cost benefit or loss factor.

In this study, all treatment groups were given the instruction as self-paced. Therefore, the learner could make the decision of when enough time was expended interacting with the presented materials for processing.

METHODS & PROCEDURES

The subjects for this study were 63 college undergraduates enrolled in an education psychology class at The Pennsylvania State University. The volunteer subjects were randomly assigned to one of three treatment groups. The instructional unit describes the human heart parts, phases, and processes. The text material and the adapted programmed text booklet has been used extensively in previous studies. The learning objectives range from basic facts and concepts to complex problem solving.

The printed verbal text material contained indentical text content for all groups. Subjects in Treatment Group 1 received instruction with the programmed booklet method that integrated verbal and static graphic information in print-based only format. Subjects assigned to Treatment Group 2 received the verbal information in printed-based text with dynamic visual materials presented on a microcomputer using implosion techniques. Implosion is considered as a frame-by-frame, inward movement of an object or objects onto another object. Treatment Group 3 received the same instructional treatment as Treatment Group 2 with the addition of a brief computer animation segment of moving arrows representing the flow of blood through the human heart. In addition to the added animation, the third group was permitted to view the completed outline drawing of the heart for an extended time during the extended animation phase.

All treatment groups were permitted to proceed through the instruction at their own rate for as long as they felt neccessary to acquire the information.

All subjects completed a self-paced four-part criterion print-based test immediately after recieving the instruction. Students were allowed to complete one part of the criterion test before proceeding to the next.

The experimental design included a posttest only ANOVA design. ALPHA was set at the .05 level. When significant F-ratios were obtained, a Scheffé test was employed to examine the multiple comparisons.

Description of the criterion test

The test items were designed to measure student achievment on specfic learning objectives. The Drawing Test was designed to measure the student's knowledge of the location of 20 parts of the human heart. The Drawing Test required the student to complete an outline of the heart using pencil and paper. The Identification Test required the student to complete a 20-item multiple-choice test measuring the student's ability to identify numbered parts from an outline drawing based on content from the instruction. The Terminology Test consisted of 20 multiple-choice items to evaluate the student's knowledge of specific terms. The Comprehension Test consisted of 20 multiple-choice items designed to measure the student's understanding of the heart and the function of the parts during the systolic and diastolic phases. All scores from the 4 tests were combined into an 80-item Total Criterion Test which measured the student's conceptual understanding of the human heart and its function as delivered in the instruction.

Individual student interaction time was recorded by the proctor at the beginning of the student's individual instructional sequence and again at the completion of test sequence. This was used to determine the total time required for the student proceed though the instructional session.

Each of the 80 items were weighted as one point. The Kuder-Richarson -20 Formula was used to measure the rationale equivalence reliability for each test. The results were as follows : Drawing Test, r=.89; Identification Test, r= .75; Terminology Test, r= .81; Comprehension Test, r= .78; and Total Tests, r= .93. Further examination to compensate for one time testing using a split-half approach with the Spearman-Brown prophecy formula revealed the following results: Drawing Test, r=.84; Identification Test, r= .87; Terminology Test, r= .80; Comprehension Test, r= .80; and Total Tests, r= .95.

RESULTS

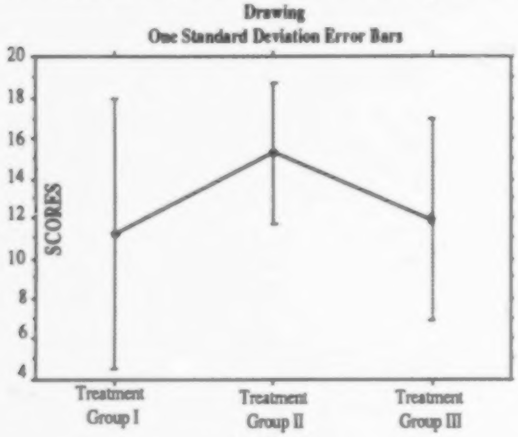
Significant differences were found among the means on the Drawing Test (F= 4.77, $d_f = 2/60$, $p < .05$); the total Criterion Test (F= 3.59, $d_f = 2/60$, $p < .05$); and Total Time for one of the three time groups (F= 7.79, $d_f = 2/60$, $p < .05$). Insignificant differences were found to exist for Terminology, Identification, and Comprehension. The Scheffé procedure was to analyze differences among the means. Alpha level was set at the .05 level. All three groups participated simultaneously at individual workstations over a five-day period.

Table 1 reveals the arithmetic average of the students' scores as a measure of central tendency.

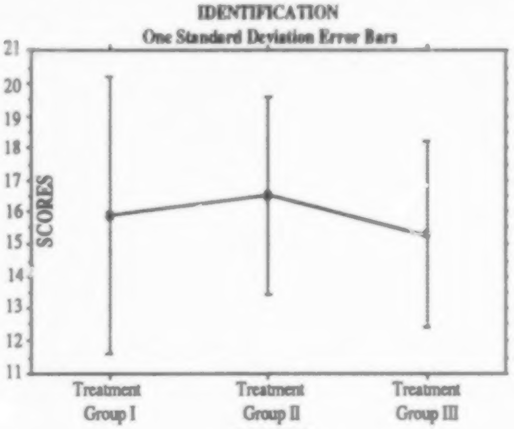
Table 1: Table of Means

	Treatment Group	N	Mean	S.D.	Std. Error
Drawing	I	20	11.20	6.82	1.52
	II	21	15.77	3.36	.73
	III	22	11.73	5.11	1.09
Identification	I	20	15.80	4.26	.95
	II	21	17.10	2.45	.53
	III	22	15.05	2.98	.64
Terminology	I	20	13.65	4.04	.90
	II	21	15.38	3.37	.74
	III	22	13.00	5.06	1.08
Comprehension	I	20	12.50	3.87	.87
	II	21	13.33	3.28	.72
	III	22	12.73	5.38	1.15
Total Score	I	20	53.15	16.40	3.67
	II	21	61.57	9.91	2.16
	III	22	50.73	14.49	3.09
Total time	I	20	49.70	11.43	2.56
	II	21	59.00	10.00	2.18
	III	22	65.05	15.59	3.32

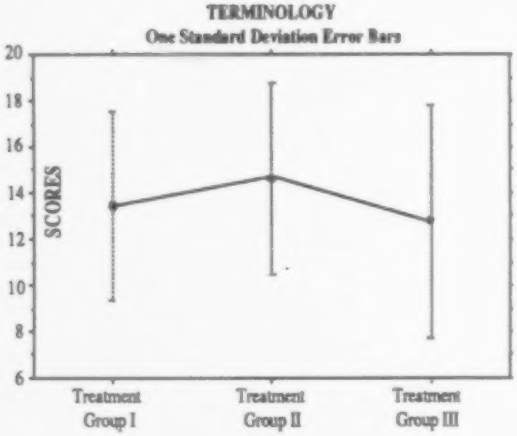
The significant differences can be readily detected by the following interaction plots found in Graphs 1 through 6.


Drawing
One Standard Deviation Error Bars

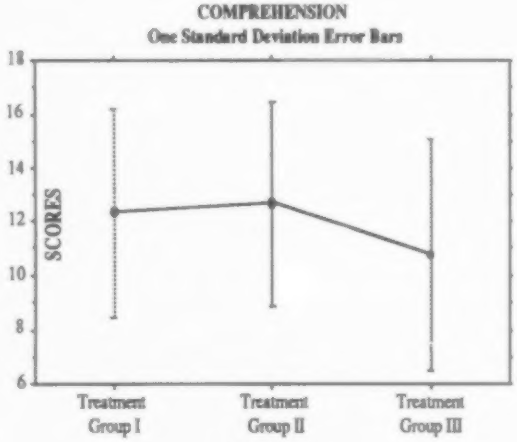
GRAPH 1


IDENTIFICATION
One Standard Deviation Error Bars

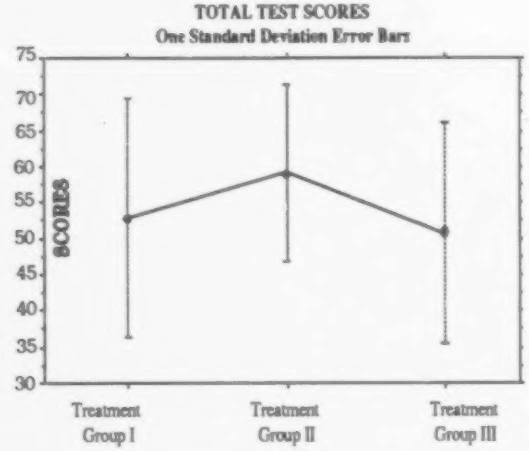
GRAPH 2


TERMINOLOGY
One Standard Deviation Error Bars

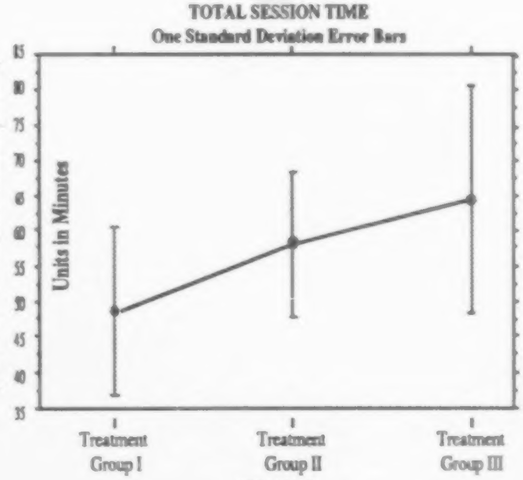
GRAPH 3


COMPREHENSION
One Standard Deviation Error Bars

GRAPH 4


TOTAL TEST SCORES
One Standard Deviation Error Bars

GRAPH 5


TOTAL SESSION TIME
One Standard Deviation Error Bars

GRAPH 6

With the Scheffé test revealing significant differences existing, a two-tailed t-Test was then used to isolate the interactions between the groups in the drawing test criterion scores, total test criterion scores, and student session time totals. The results can be found in Table 2.

TABLE 2: TWO-TAILED t-TEST (p=.05)

	Treatment Group	N	df	t Value	Prob(2-tail)	Result
Drawing	I vs.	20	2/39	- 2.77	.0086	I<II
	II	21	2/39	2.77	.0086	II>I
	I vs.	20	2/40	- .3124	.7564	I=III
	III	22	2/40	.3124	.7564	III=I
	II vs.	21	2/41	3.0434	.0041	II>III
	III	22	2/41	- 3.0434	.0041	III<II
Total Score	I vs.	20	2/39	- 2.008	.0524	I<II
	II	21	2/39	2.008	.0624	II>I
	I vs.	20	2/40	.5083	.6141	I=III
	III	22	2/40	.5083	.6141	III=I
	I I vs.	21	2/41	2.8509	.0068	II>III
	III	22	2/41	- 2.8509	.0068	III<II
Total session time	I vs.	20	2/39	- 2.8685	.0066	I<II
	II	21	2/39	2.8685	.0066	II>I
	I vs.	20	2/40	- 4.3231	.0001	I<III
	III	22	2/40	4 .3231	.0001	III>I
	I I vs.	21	2/41	-1.667	.1032	II=III
	III	22	2/41	1.667	.1032	III=II

Summary of findings

Significant differences were detected among the students in the three treatment groups for the drawing criterion with, the Treatment Group II producing results greater than Treatment Group I or Treatment Group III. A significant difference existed between the two computer groups (TGII and TGIII) with Treatment Group II being greater than Treatment Group III. No significant differences were detected between Treatment Group III and Treatment Group I, but the mean score for Treatment III was slightly higher than Treatment Group I. Treatment Group II had a more narrow band of the standard deviation of student scores than either Treatment Group I or Treatment Group III. These results cause a rejection of the hypothesis (H_1) that there are no significant differences in achievement among the students in the three treatment groups.

The resulting analysis of the Total Test Criterion scores showed significant differences do exist among student achievement in the three treatment groups. The results follow the pattern of the drawing test criterion scores thus enabling the rejection of H_2.

H(3) can be rejected as a result of the student session time analysis that revealed significant differences between the computer groups and the print based group. Students in Treatment Group II and Treatment Group III spent significantly more time interacting with the instructional content than Treatment Group I. However, it should be noted that there was not a significant difference among the students who were assigned to the two computer groups (TII & TIII).

From the results of this study, the following statements can be derived:

1. Improvement of student achievement on specific learning objectives measured by the drawing criteria was realized by students assigned to the computer groups over the print-based only group with the computer animated implosion having the greatest effect.

2. Improvement of student achievement on specific learning objectives measured by the total criterion was realized by students assigned to the computer group with the computer-animated implosion only over students assigned to the computer group with the additional animation of the blood flow.

3. Computer animation requires significantly more time for students to interact with instruction content than print-based materials only instruction delivery systems.

DISCUSSION

As the development of intelligent computing systems proceeds toward reality, the context of the educational environment has to change. With this change, development of expert systems will enable educators and trainers to incorporate computer on-line curriculum design strategies for individualized diagnostics and prescriptions to meet specific differences in student learning styles.

This study was designed as micro-analysis to evaluate very specific effects of an instructional strategy on learning objectives. The implosion strategy was selected as an information-organizing technique to evaluate what particular learning objectives would be affected by computer animation.

Computer-animation strategies require more time for the student to interact with instruction. A possible drawback to utilizing animation strategies might be the required additional instructional development time.

To fully realize the benefits of using animation, careful judgement and definitive objectives for the student must be used when incorporating computerized animation in the instructional design. The benefits can be defined by evaluating a balance of desired learner outcomes and time available to the learner with considerations for instruction development time, effort, and equipment requirements.

The continuing development and availability of new and powerful computer authoring systems allow the non-computer instructional designer to access developing computer instruction delivery systems. These new systems are reducing the amount of time required for developing and implementing an instructional package. With this, the visual qualities are also evolving that allow for more and more detail and realism.

The results of this study reaffirm that for instruction to be optimized, the foundations of the instructional design must remain rooted in sound education psychology theory with defined objectives. The need for continued precise research investigations of the effects of specific strategies are needed as we proceed into the development intelligent, expert delivery systems.

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Enhancing Visual Literacy of Engineering Students Through the Use of Real and Computer Generated Models

Craig L. Miller

Introduction

The ability to spatially visualize solutions to problems is an important skill for individuals in many diverse professions. Jensen (1986), in a survey of professional engineers in educational and industrial settings, found that spatial abilities are the most important engineering graphics concept that an individual should possess to be successful in the engineering profession. Bertoline (1988) notes that spatial ability attributes are important for the seemingly unrelated areas of achievement in mathematics (Maccoby & Jacklin, 1974), chemistry (Talley, 1973), biology (Lord, 1985), and science (Small & Morton, 1985).

Even though spatial abilities are indeed important for many fields, secondary schools and universities continue to emphasize a verbal approach to learning (Horton, 1982). Bertoline (1987) notes that students are given little or no formal instruction in the use and development of spatial abilities. Liben (1981) contends that background experiences and McGee (1979) claims that sexual differences may cause many individuals to initially possess lower spatial abilities, but they note that spatial abilities can be developed and enhanced through formal educational and informal experiences. If one of the goals of engineering education is to successfully prepare individuals for various engineering professions, instructional approaches should be developed that allow students to augment and advance their spatial abilities. If students are not given an opportunity to develop and enhance their spatial abilities through educational experiences they may abandon their quest to become engineers or fail to achieve their potential as practicing engineers.

Because spatial abilities have been and continue to be so important, most engineering and technical educational programs have included engineering graphics as a basic component of their curricula (Bertoline, 1987). Presenting abstract conceptual ideas graphically through the use of sketches, mechanical drawings, and CADD data bases is a fundamental tool used by engineers and technologists (Simoneau, Fortin, and Ferguson, 1987).

The development and advancement of spatial abilities is a very important objective in the foundation and development of many different disciplines, including engineering graphics, but student learning style differences typically are not addressed by the curriculum. An extensive review of the literature in engineering graphics education by Miller (1990) has shown that student learning style differences are typically not considered in planning spatial instruction in engineering graphics and that research in learning styles is limited. The oversight of the impact of learning styles in the engineering graphics curriculum may have caused and may continue to cause students to have problems developing and advancing their spatial abilities.

Individual learning style differences can influence performance on spatial tasks allowing some individuals to excel while others fail. Piaget and Inhelder (1967) suggest that spatial cognition is a learned trait that develops in various sequential stages and Liben (1981) suggests that different factors influence the development of spatial cognition. McGee (1979) contends that there is empirical evidence for sex differences in spatial cognition. Research also indicates that various learning styles must be considered as significant factors when developing and planning curricula involving the development and advancement of spatial cognition (Ausburn and Ausburn, 1978). Thus, individual learning style differences can affect the development of an individual's spatial cognition and should be of central interest in any engineering graphics curriculum.

The above information indicates that spatial ability is of central importance to many professions including engineering and that learning style differences must be considered. Because engineering graphics is the formal educational setting for the development and enhancement of spatial abilities, instructional systems should be developed that are specifically tailored to the individual learning style of the student. But any instructional system including media should have a formal research base and be thoroughly tested before being implemented into widespread instructional use.

Saloman (1970) contends that research in instructional methods and media consists of three major components: it must consider the method used to convey the information, the psychological requirements of the task to be undertaken, and the individual characteristics of the learners.

Lowenfield (1945) identified two different characteristics of learners: the visual and the haptic. Visual-haptic perceptual typology theory was developed by Vicktor Lowenfeld after extensive research in art education in both Europe and the United States. Lowenfeld (1939) distinguishes between two distinct types of individuals and how they perceive and react to the world of experiences, or in other words, how they perceive and organize their external environment. The two learning styles that he identified are the visual type and the haptic type.

Lowenfeld contended that these two learning styles fall on the opposite ends of a continuum of how they perceive the external world. The visual type relies almost entirely on visual imagery as a means of perception and would be lost without it. The visual type is a perceptual observer or spectator who normally approaches objects from their visual appearance, uses the eyes to discover the surrounding environment, and transforms kinesthetic and tactile experiences into visual ones. On the other hand, a haptic individual does not have the tendency to visually see the whole object, then break it up into its component parts and reassemble it into a whole. Haptic individuals usually do not transform kinesthetic and tactile experiences into visual imagery but rely upon touch or the kinesthetic mode of perception (Lowenfeld & Brittain, 1987).

Not all instructional approaches may be appropriate for the haptic or visual perceptual type of individual. Except for the use of real models most traditional engineering graphics instruction has been suitable for only visual perceptual type individuals because it is based on visual imagery. Since approximately 25 percent of the population may be haptic perceptual type learners, these individuals are at a distinct disadvantage when they are asked to use their spatial abilities in traditional engineering graphics curricular experiences. If a significant number of engineering students are haptics then these individuals may lose engineering career opportunities because the traditional curricular approaches did not match their learning style.

The engineering graphics educator then must question how the instructional materials or media can be developed that will allow the haptic perceptual types to develop or advance their spatial abilities. Salomon (1970) advocates the use of instructional approaches and media that execute the mental processes for the learners when the learners are unable to do so themselves. He terms this process supplantation and defines it as "the function accomplished by an explicit presentation of what would otherwise have to be done covertly by the learner himself, such that a certain learning objectives will be obtained." (Salomon, 1970, p. 41). The practical utilization of the supplantation theory could be the bridge that allows the haptic perceptual type individuals to develop and enhance their spatial abilities. These supplantation techniques might not be needed by the visual perceptual type of individual. Because visual individuals already possess advanced spatial abilities the development and utilization of nontraditional instructional approaches for these individuals could be a waste of time and resources because they do not need or utilize them.

Traditionally, the use of real models has been debated by engineering graphics educators for instructional use. One group who advocate the use of real models claim that their use allows students to grasp the concepts of three-dimensional thinking through orthographic projection (Vanderwall, 1981; Young, 1952; Rowe, 1938, 1945) while other educators claim that the use of models is nothing more than a crutch (French, 1913; Orth, 1941).

More recently, research by Zavotka (1985), Anand, et al. (1987), and Bertoline and Miller (1989) has used computer-generated wireframe and surface models to allow students to improve their spatial abilities. If the students are haptic in nature, then the use of real or computer-generated surface models may supplant the transformation from the real object to the three-dimensional representation of the object onto a two-dimensional plane through use of orthographic projection theory. This supplantation technique may allow haptic learners to develop and advance their spatial abilities. The use of computer-generated surface models may not be needed or utilized by visual learners, thus utilizing expensive computer hardware and software on visual learners may not enhance their spatial abilities.

Languis (1983) and Anand, et al. (1987) note that computer technology is advancing rapidly in its ability to provide educators with a wealth of potential tools for providing many different experiences. Although technological developments are motivated largely by the needs of fields other than education, the apparent promises of these developments for improving education are manifold (Languis, 1983). The advent of the computer and development of powerful computer graphics software has also changed the methods and presentation structure of the engineering graphics curriculum. The development of computer graphics technology has presented the engineering graphics education profession with unique opportunities to present abstract concepts in ways that were impossible only a few years ago. Because of the abstract nature of spatial concepts, engineering graphics educators should consider the use of computer technology in the development of spatial abilities. The utilization of the computer in educational settings must be controlled by the existing literature in learning, learning styles, and instruction. The use of computer technology has come into the engineering graphics curriculum with limited identifiable research efforts in learning styles; thus, many students' learning styles will not match the instruction as it is presented.

Statement of the Problem

The problem of this study is that many times the instructional approaches used to develop and advance the spatial abilities of engineering students do not match individual learning styles of the students.

Purpose and Hypotheses of the Study

The purpose of this study was to determine the effectiveness of using computer-generated surface models and real models to develop students' spatial abilities when compared to using traditional methods for engineering students classified as visual or haptic perceptual types. The following research hypotheses for this study were tested at = 0.05:

1. Lowenfeld's claim that 47 percent of the population are visuals, 23 percent are haptics, and the remaining 30 percent are indefinites will hold true for the population drawn for use in this study.
2. The experimental instructional methods and media (traditional supplemented by real models, and traditional supplemented by computer-generated surface models) will interact with the learning style (visual-haptic mode) of the students, allowing for a greater increase in spatial abilities than would have occurred with the traditional engineering graphics instructional methods or media.

3. The measurement of visual-haptic aptitude will not correlate with the measure of spatial ability.

Instructional Setting for the Study

Technical Graphics 108 during Fall Semester 1990 was a one-hour traditional sketching-based engineering graphics course that consisted of a one-hour lecture and a one-hour laboratory meeting once a week. It was offered to all freshman engineering students and covered the topics of visualization, orthographic multiview sketching, pictorial isometric sketching, and orthographic reading. All formal instructional content was presented during the one-hour lecture. The one-hour laboratory did not introduce any new instructional content but was designed so that the students were able to work on their homework assignments and receive additional help from an undergraduate teaching assistant.

Instrumentation

Two standardized instruments were used in this study: The *Successive Perception Test I* (United States Army Air Corps, 1944) and the *Mental Rotations Test* (Vandenberg & Kruse, 1978). The *Successive Perception Test I* was used to determine the visual/haptic perceptual type of the subjects in the population; thus it was used to assign subjects to the treatment groups.

The *Successive Perception Test I* (SP1) contains 38 items. Three items are practice items and 35 are the actual test items. The SP1 consists of black abstract line drawing symbols drawn on separate pieces of white cardboard. The white cardboard pieces on which the symbols were drawn (symbol cards) are then placed, one at a time, into a white opaque cardboard cover plate in which a horizontal rectangular window had been cut. The SP1 film shows the symbol cards as they are pulled through the cover plate, thus exposing small sections of the symbol until the entire symbol has been displayed. The entire symbol is shown through the window in one and one-half seconds. The subject can see only that part of the symbol that is displayed inside the window. As the symbol passes through the window the subject must remember the entire design and pick the corresponding symbol from five alternatives (see Figure 1).

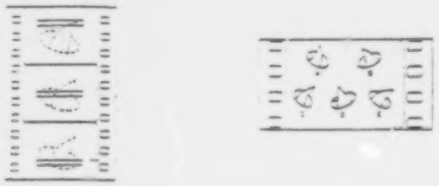

Figure 1. Illustration of a test question and answers from the *Successive Perception Test I*.

The *Mental Rotations Test* (see Figure 2) was used to measure the spatial ability of the subjects. Although there are various measures of spatial ability, the *Mental Rotations Test* was selected for use in this study because this test has been empirically proven to be a valid and reliable test of spatial ability. *The Directory of Unpublished Experimental Mental Measures* shows validity correlations with other spatial tests to range from .31 to .68 (Goldman & Osborne, 1985, p. 238). Vandenberg and Kruse (1978) report that this test has only shown low correlations with tests of verbal ability. *The Directory of Unpublished Experimental Mental Measures* reports that this test has reliability ratings of .88 with the Kuder-Richardson 20 technique and the one-year test-retest correlations were .83 (Goldman & Osborne, 1985, p. 238).

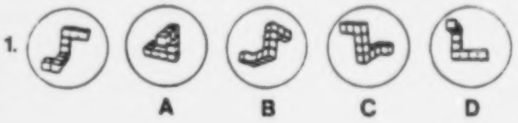

Figure 2. Illustration of a test question and answers from the *Mental Rotations Test*.

Development of the Instructional Materials

Sixteen color rendered computer-generated objects were developed from the textbook pictorials. A programmed macro was also developed that would allow the user to select an object and rotate it in any direction with the use of two keystrokes.

Sixteen sets of twenty-five wooden blocks of the figures were also developed. The real models were solid wooden blocks. The surfaces were painted to match the computer-generated models and they were the same size as the computer-generated models.

Administration of the Successive Perception Test I

The entire population of Technical Graphics 108 was administered the *Successive Perception Test I* during the first laboratory session. From the results of this test the students were to be classified as either being haptic or visual perceptual types. L. A. Ausburn (1979) classified individuals as visuals if they scored a 21 or higher, or haptics if they scored 14 or less on this test. She based these scores on Lowenfeld's (1945) theory of visual/haptic perceptual type.

After reviewing the data of the *Successive Perception Test I*, a decision was made to redefine visual/haptic perceptual type for this study because there would not have been enough haptic students present in the population to allow a sample to be drawn. The mean score of the *Successive Perception Test I* was 21.493 with a standard deviation of 3.956. Because these values were relatively consistent throughout the population, a haptic perceptual type was defined as scoring a 17 or below and a visual perceptual type was defined as scoring a 25 or higher on the *Successive Perception Test I*.

Selection of the Sample

The population (497 subjects) from which the sample was drawn consisted of freshman engineering students enrolled in Graphics for Engineers (Technical Graphics 108) during the Fall Semester of 1990 at the West Lafayette, Indiana, campus of Purdue University. The sample selected for the study was based upon the adjusted visual/haptic scale as determined by the *Successive Perception Test I*. The sample (150 subjects) involved students who were identified as possessing strong visual (75 subjects) or haptic (75 subjects) aptitude. Individuals classified as visuals (25 or higher on the *Successive Perception Test I*) were randomly placed into either the traditional exercise (n=25), the computer-generated model group (n=25), or the real model group (n=25). This same procedure was also used to randomly assign the haptic subjects (17 or lower on the *Successive Perception Test I*) into the traditional exercise (n=25), the computer-generated model group (n=25), or the real model group (n=25).

The experimental laboratory sessions were in place of their regularly scheduled one-hour laboratory sessions. The experimental laboratories were offered at alternative times to the regular laboratory sessions. This was necessary because of the logistical constraints of laboratory space being available during the study. Although the students had to attend a laboratory session at a different time than their normal laboratory time, all laboratory sessions, both traditional and experimental, were 50 minutes in length and a student could attend only one laboratory session each week. The size of the traditional laboratories ranged from nine to nineteen students. This was determined by how many students volunteered for the study and left the traditional classroom session. The size of the experimental laboratories ranged from five to eighteen students. This was determined by how many students volunteered to participate in one of the experimental laboratories at a given time. The experimental laboratories were offered at various times during the day and in the evenings.

Administering the Treatment

Throughout this study all students received the same laboratory problems and the same amount of time in the laboratory sessions. The only differences between the control group for the study and the two experimental groups were the instructor, the treatment, and the time during the day in which the laboratory sessions were held.

The administration of the treatment for this study lasted for four weeks. During each week of the study the students in all treatment groups were given drawing problems that contained a pictorial sketch of a real model and an orthographic grid on which they were to sketch a three-view orthographic representation of the object. Four problems were to be completed during each week. The students had to determine the most descriptive view of the object and sketch this as the front view. They then had to sketch the top view and one side view of the object. The grades for the exercises were based upon the correct visualization of the object and the accuracy of the sketched orthographic representation based on engineering graphics standards. The students were required to stay in laboratory the full length of the laboratory session unless they completed all four problems and turned them in to their instructor. If they did not complete all four problems they were allowed to work on them outside of laboratory and these problems were due at the beginning of the next laboratory session.

During the first week of the treatment the students were required to complete four drafting assignments (see Figure 3). The first four exercises were introductory. The purpose of these exercises was to introduce the students to the concepts of orthographic projection. The geometry of these problems consisted of only normal rectangular and normal cylindrical solids. The students were required to sketch each view according to orthographic standards, including hidden features and lines of symmetry.

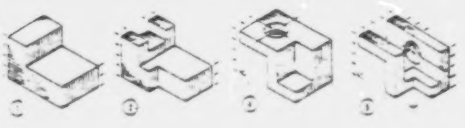

Figure 3. Week one problems.

The geometry of the problems used during the second week was more complex than the geometry of the problems used during the first week (see Figure 4). These problems, like the first week of problems, contained normal rectangular and normal cylindrical solids. In addition, they introduced inclined rectangular solids. The purpose of these problems was to reinforce the standards and theory of orthographic projection by showing how an inclined surface is different from a normal surface and how inclined surfaces must be represented on a two-dimensional drawing plane.

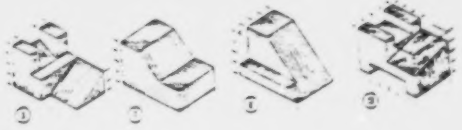

Figure 4. Week two problems.

During the third week of the treatment the complexity of the geometry of the problems was increased (see Figure 5). The problems contained normal rectangular, normal cylindrical, and inclined surfaces. The purpose of these problems was to further reinforce orthographic projection theory and standards and to give the students more problems to further develop their spatial and sketching abilities. No new concepts were introduced during this week.

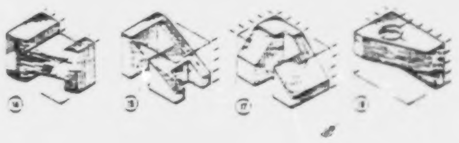

Figure 5. Week three problems.

During the fourth week the complexity of the geometry of the problems was further increased (see Figure 6). During this week oblique surfaces were introduced to the students. The problems also included normal and inclined surfaces. The problems containing oblique surfaces were the most complex drawings that the students had to visualize and sketch. These problems progressed from simple to complex oblique surfaces. The students were then informed that the treatment portion of the study was complete and that they should report to their regular laboratory the following week.

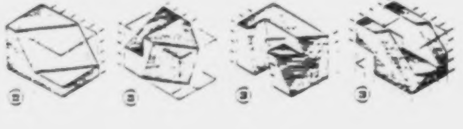

Figure 6. Week four problems.

The week following the last treatment, the entire population of students was administered the *Mental Rotations Test* and the *Successive Perception Test I*. The *Mental Rotations Test* was used to measure the spatial abilities of the students and the *Successive Perception Test I* was used to determine the perceptual aptitude of the students. The students were then informed that the study was completed. During the remainder of the semester the students progressed through the course utilizing traditional instructional methods.

During the final laboratory meeting of the semester the subjects who participated in the study were asked to complete a questionnaire concerning the study. The purpose of this questionnaire was to determine if the subjects felt that the treatment they received helped or hindered them throughout the semester, and specifically if it helped them to develop and advance their visualization abilities.

Research Design

The main objective of the study was to determine the effects of perceptual type and instructional treatment upon the spatial ability of the subjects. To determine if the perceptual type, instructional treatment, or an interaction between perceptual type and treatment significantly affected the subjects' spatial ability, a 2 x 3 factorial experimental design, the posttest-only control group design was used. This overall design meets the criteria for being an experimental study by having individual students randomly selected from two matched pools of attribute variables (visual/haptic perceptual aptitude) to three levels of the independent variable (traditional, real model supplemented, or computer-supplemented instructional approaches).

Results of the Study

The following set of procedures was used for the statistical analysis for this study. The first section is concerned with a quality control check of the reliability of the *Successive Perception Test I*. Because this test has not previously had consistently high reliability ratings, the reliability of the *Successive Perception Test I* was examined for the population used in this study.

The procedure used to determine the reliability of the *Successive Perception Test I* involved the use of the Cronbach Alpha test. This test was done on both the pretest and posttest administration of the *Successive Perception Test I*. The reliability score for the pretest was .54 and for the posttest was .53.

The *Successive Perception Test I* shows a somewhat low reliability coefficient for both administrations. Thorndike and Hagen (1969) note that reliability of a test must be considered in terms of other procedures with which it is in competition. In the case of the *Successive Perception Test I* there is no other group measure of visual/haptic aptitude currently available. They note further that the accuracy of conclusions drawn from a test with low reliability is greater with group data than with individual data. Thorndike and Hagen (1969) state, "A test with relatively low reliability will permit us to make useful studies of and draw accurate conclusions about groups, especially groups of substantial size, but quite high reliability is required if we are to speak with confidence about individuals (p. 95). Therefore, because a large group administration of the *Successive Perception Test I* was used it was considered a reliable measure for use in this study.

The second data set was concerned with whether Lowenfeld's theory of visual/haptic perceptual type was reflected in the population used for this study. A chi-square goodness-of-fit compared Lowenfeld's theoretical percentages with the actual percentages of the population used in this study. This statistical analysis was conducted on the adjusted visual/haptic perceptual scale used for this study which defined a haptic perceptual type as scoring a 17 or below, a visual perceptual type as scoring a 25 or higher, and an indefinite perceptual type as scoring between 18 and 24 on the *Successive Perception Test I*.

A significant difference was found indicating that Lowenfeld's prediction that 47 percent of the population are visual, 30 percent of the population are indefinite, and 23 percent of the population are haptic was not correct for the population used in this study. Because the calculated probability was 0.0001, the null hypothesis was rejected.

The third set of data investigated if the experimental instructional methods and media (traditional supplemented by real models, and traditional supplemented by computer-generated surface models) interacted with the learning style (visual-haptic perceptual type) of the students, allowing for a greater increase in spatial abilities than would have occurred with the traditional engineering graphics instructional methods or media. The results of this research hypothesis is broken into two sections. The first section analyzed the posttest scores of the *Mental Rotation Test* using one and two factor ANOVA's to determine if there was a significant difference between perceptual type, treatment, and interaction of these variables. The second section presents the results of the summative evaluation administered at the conclusion of the course.

The first tests investigated if there were significant interactions between visual/haptic perceptual type and treatment on spatial ability as measured by the *Mental Rotations Test* and also investigated if the main effects of treatment and perceptual type were significant. This information was analyzed using a two-factor analysis of variance. The ANOVA suggests that there is no significant interaction between visual/haptic perceptual type and treatment on the *Mental Rotations Test*. Because the calculated probability was 0.6955, no interaction between perceptual type and treatment occurred and the null hypothesis of no interaction was not rejected (see Table 1).

The ANOVA results showed that there was a significant difference between the group means of visual and haptic perceptual type. To reject the null hypothesis, the probability associated with the calculated value of the test statistic must be equal to or less than the 0.05 alpha level. Because the calculated probability was 0.0001 the null hypothesis of no difference between visual and haptic perceptual type was rejected (see Table 1).

Also, the ANOVA suggests that there are no significance differences between the treatment groups. Because the calculated probability was 0.24, the null hypothesis of no difference between treatment groups was not rejected (see Table 1).

Thus, the results of the two-way ANOVA show that there was a significance difference between visual and haptic perceptual type individuals' spatial abilities as measured by the *Mental Rotations Test*. The two-way ANOVA results also show that there were no significant differences between the treatment groups nor was there any interaction between the treatments and perceptual type.

Because interaction between treatment and perceptual type did not occur, specific treatment and perceptual type groups were compared with each other using a one-factor ANOVA. This statistical technique was used to determine if significant differences occurred in spatial ability development as measured by the *Mental Rotations Test*.

Table 1
Two Factor ANOVA Data for the *Mental Rotations Test*

Source	Degrees of freedom	Sum of squares	Mean square	F value	P value
Perceptual type	1	472.52	472.52	30.84	0.0001*
Treatment	2	41.32	20.66	1.35	0.2630
Perceptual x treatment	2	11.16	5.58	0.36	0.6955
Error	136	2083.48	15.32		

*$p < .05$

To reject the null hypothesis, the probability associated with the calculated value of the test statistic must be equal to or less than the 0.05 alpha level. Contrasting the mean scores between visual perceptual type with traditional treatment and visual perceptual type with real model treatment, the probability value was 0.33. Contrasting the mean scores between visual perceptual type with traditional treatment and visual perceptual type with computer-generated model treatment, the probability value was 0.67. Contrasting the mean scores between visual perceptual type with real model treatment and visual perceptual type with computer-generated model treatment, the probability value was 0.16. Contrasting the mean scores between visual perceptual type subjects between all three treatments, the probability value was 0.07. Thus, for visual perceptual types no significant differences in spatial ability as measured by the *Mental Rotations Test* , was found between the three treatment groups (see Table 2).

Table 2
One Factor ANOVA Data for the *Mental Rotations Test* by Visual Perceptual Type

Source/ Contrast	Degrees of freedom	Sum of squares	Mean square	F Value	P Value
G1 vs G2	1	14.64	14.64	0.96	0.33
G2 vs G3	1	30.42	30.42	1.99	0.16
G1 vs G3	1	2.67	2.67	0.17	0.68
G1 vs G2 vs G3	2	31.01	16.01	1.04	0.35
Error	136	2083.48	15.32		

G1 = Visual Perceptual Type with Traditional Treatment
G2 = Visual Perceptual Type with Real Model Treatment
G3 = Visual Perceptual Type with Computer-Generated Model Treatment

The one-factor ANOVA statistical technique was also used to determine if significant differences occurred in spatial ability development for haptic perceptual types by treatment. Spatial ability was measured by the *Mental Rotations Test.*

To reject the null hypothesis, the probability associated with the calculated value of the test statistic must be equal to or less than the 0.05 alpha level. Contrasting the mean scores between haptic perceptual type with real model treatment and haptic perceptual type with computer-generated model treatment, the probability value was 0.65 (see Table 3).

Because there was no difference in the mean scores between haptic perceptual type with real model treatment and haptic perceptual type with computer-generated model treatment, haptic perceptual type with traditional treatment was contrasted against the mean score of these two groups. The probability value was 0.26. Contrasting the mean scores between haptic perceptual type subjects between all three treatments, the probability value was 0.48 (see Table 3).

For haptic perceptual types, no significant differences in spatial ability as measured by the *Mental Rotations Test* was found between the three treatment groups. Thus, for haptic subjects, the mean scores of 10.32 for the computer-generated model group, 10.86 for the real model group, and 9.48 for the control group were not significantly different.

Table 3
One Factor ANOVA Data for the *Mental Rotations Test* by Haptic Perceptual Type

Source/ Contrast	Degrees of freedom	Sum of squares	Mean square	F Value	P Value
G5 vs G6	1	3.12	3.12	0.20	0.66
G4 vs G5 & G6	1	19.39	19.39	1.27	0.26
G4 vs G5 vs G6	2	22.98	11.15	0.73	0.48
Error	136	2083.48	15.32		

Note. Key

G4 = Haptic Perceptual Type with Traditional Treatment
G5 = Haptic Perceptual Type with Real Model Treatment
G6 = Haptic Perceptual Type with Computer-Generated Model Treatment

The second section that evaluated the visual/haptic perceptual type and instructional treatment was done by a summative questionnaire. The purpose of this instrument was to determine how the subjects felt about the study and to see if there were differences between perceptual type and treatment groups. The data that was gathered by this questionnaire was ordinal data except for question five which was nominal data. The inferential statistic used was the Chi square statistic.

The first question asked the subjects to rate on a five point scale (5 = agree, 1 = disagree) whether they felt that the instructional setting they were in during the study helped them to visualize problem solutions. An overall median score of 4 was given by the students for question one. The results of the Chi square statistic for question one indicated that there were no significant differences between perceptual type or treatment.

Question two asked the subjects to rate on a five point scale (5 = agree, 1 = disagree) whether they felt that too much time was spent on this study. An overall median score of 2 was given by the students for question two. The results of the Chi square statistic for question two indicated that there were no significant differences between perceptual type or treatment.

Question three asked the subjects to choose one type of instructional treatment that they thought would have helped them to advance their spatial abilities. Their choices were computer-generated models, real models, traditional exercises, or a combination of all three. An overall percentage breakdown showed that the students thought a combination of all three treatments (51%), followed by real models (33%), computer-generated models(10%), and by traditional assignments (6%) was the best instructional technique. No significant differences were found between perceptual type or treatment on question three.

Question four asked the subjects to rate on a five point scale (5 = agree, 1 = disagree) if they felt that real model exercises should be integrated into the course throughout the semester. An overall median score of five was given by the students for question four. The results of the Chi square statistic for question four indicated that there were no significant differences between perceptual type, treatment, or perceptual type by treatment.

Question five asked the subjects to rate on a five point scale (5 = agree, 1 = disagree) if they felt that computer-generated model exercises should be integrated into the course throughout the semester. An overall median score of four was given by the students for question five. The results of the Chi square statistic for question five indicated that there were no significant differences between perceptual type, treatment, or perceptual type by treatment.

Question six asked the subjects to rate on a five point scale (5 = agree, 1 = disagree) if they felt that a combination of real model exercises and computer-generated model exercises should be integrated into the course throughout the semester. An overall median score of five was given by the students for question six. The results of the Chi square statistic for question six indicated that there were no significant differences between perceptual type, treatment, or perceptual type by treatment.

Question seven asked the subjects to rate on a five point scale (5 = agree, 1 = disagree) if they felt that the instructional treatment they used during the study helped them to receive a better grade in the course. An overall median score of four was given by the students for question seven. The results of the Chi square statistic for question seven indicated that there were no significant differences between perceptual type, treatment, or perceptual type by treatment.

The fourth hypothesis was concerned with the correlation between the posttest administration of the *Successive Perception Test I* and the *Mental Rotations Test*. The procedure used to test this hypothesis was the Pearson correlation coefficient. A significant difference was found that indicated there was a relationship of .3298 between the *Successive Perception Test I* and the *Mental Rotations Test*. To reject the null hypothesis, the probability associated with the calculated value of the test statistic must be equal to or less than the .05 alpha level. Because the calculated probability was .0001, the null hypothesis of no relationship between these two tests was rejected.

Discussion

The findings indicate that the reliability of the *Successive Perception Test I* is low. This may account for the insignificant statistical differences between the treatment and perceptual types. If this test was not reliable at sorting visual from haptic subjects then a haptic subject could have been classified as an indefinite or visual. A visual subject could also have been mistakenly classified as an indefinite or haptic.

Because Lowenfeld's theoretical classification was not reflected in this population as stated in research hypothesis two, this leads to further questioning of the reliability and validity of the *Successive Perception Test I*. But engineers by academic selection may be more visual than the normal American population.

The findings indicated that there was no significant difference in the effectiveness of using real models, computer-generated models, or traditional curricular approaches for either visual or haptic subjects nor was there any interaction between these variables in the advancement of spatial abilities. Group mean scores of the posttests were very close, indicating that the students' spatial abilities were very even regardless of the tool used to develop and advance their spatial abilities. When further analyzed, visual subjects had possessed higher spatial abilities than haptic subjects. This conclusion supports the theories of Vicktor Lowenfeld.

Although there was not statistical support for greater advances in spatial abilities by the various treatment groups, the summative questionnaire provided evidence that the use of a combination of real models, computer-generated models, and traditional curricular approaches was supported by all of the students in the study. This questionnaire also showed that the students did not think too much time was spent on the study, and that the use of these additional instructional tools helped them to advance their spatial abilities.

Finally, although there was a significant correlation between the *Successive Perception Test I* and the *Mental Rotations Test*, the correlation score of .3298 was at best a weak correlation. Thus it can be concluded that these tests are measuring different aptitudes.

Based on the findings, experience of the researcher, and the review of the literature, supplementing traditional curriculum approaches with real and computer-generated models helps most students to advance their spatial abilities. From this conclusion, there is a strong argument in favor of supplementing traditional engineering graphics instruction with real and computer-generated models. This supports much of the literature that advocates the supplantation of cognitive processes through instructional tools, especially when the individual learning styles of the individuals are considered.

Recommendations

The recommendations that follow were developed from the findings of this study and the experience of the researcher.

1. The use of the *Successive Perception Test I* must be questioned. Because of low reliability and questionable validity the use of this test is not recommended. Thus it is recommended that a new visual/haptic perceptual test be developed with normed validity and reliability statistics.
2. Expanded research in learning styles and spatial ability development. This area is in need of more research. The results of this study could be used as a starting point for greater research in this area.
3. More educational research by engineering graphics educators in learning styles and spatial abilities development. Very little documented research now exists even though we claim that our curriculum is responsible for the development of spatial abilities.
4. More integration of advanced computer technology to supplant for the students many of the difficult areas of visualization. The development of low cost animations hardware and software and the use of compact disks may hold the key for the development of spatial abilities.

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The Effects of a Color Code in Graphic Presentation and Assessment on Remembering Verbal Material

Peggy Ann Posekany Pruisner

Introduction

Literacy allows the reader to make sense of the world. Since the world is continually changing, so are the requirements for literacy (Venezky, 1990). In the contemporary context, a literate person moves beyond the conventions of print and processes all possibilities of written information. Verbal literacy, the ability to read and write a language, is only one dimension of literacy. Visual literacy, the ability to understand and make visual messages (Dondis, 1973), enables a learner to successfully interpret a broader context of the information environment. The prevalence of graphics or visual, pictorial alternatives to prose (Macdonald-Ross, 1978) today makes it imperative to recognize the comprehension of graphics as an integral part of the reading process and to consider instruction aimed at developing visual literacy as essential across the curriculum (Robinson, 1991).

The wide use of graphics, however, does not mean they are effectively designed and integrated into context (Gerber, 1985). On the contrary, educators have neglected to instruct graphic designers, teachers, and students to manipulate and interact with the graphic features or characteristics in ways that enhance literacy. Through the manipulation of graphic features, it may be possible to more efficiently access and enhance the construction of schema, the reader's network of interrelated experiences stored in the memory (Rumelhart, 1980), and to utilize schema-based learning strategies (Gallini, 1989) that facilitate comprehension and recall.

Among the graphic features that could aid in effective communication, purposeful learning, and enhanced recall and retention is the use of color (Dondis, 1973; Hartley, 1986; Kostelnick, 1988). There is an overwhelming amount of literature on color, but the research specific to color and learning is contradictory and confusing, while there are few specific applications of color coding to facilitate in the comprehension of graphics. The review of literature revealed a noteworthy, classic study that effectively utilized color as a code in the design of graphic study materials. Using color and black/white, self-paced learning booklets with simple line drawings, word labels, and prose text, Lamberski (1980, 1982) measured cognitive knowledge tasks. Although the use of color in evaluation materials did not affect achievement, color-coded, self-paced instructional materials were superior to the black/white presentation materials on both immediate and delayed posttests.

Concerning the use of color in the teaching-learning process, Dwyer and Lamberski (1982-83) reported that the learner must engage in extensive coding during information processing. A color-coding process may enable the receiver to retain critical information and to disregard redundant or irrelevant information. An effective, systematic color code assists the reader in organizing and categorizing stimuli into meaningful patterns. The need for conclusive research to support the use of a color code in graphics to aid comprehension and remembering was the basis for this study.

Methodology

Statement of the Problem

In response to the frequent presentation of information in graphic form, research stresses the need for and importance of well-designed graphics (Gerber, 1985; Kostelnick, 1988; Peterson, 1983). Empirical research needs to be conducted to determine the effects of the manipulation of graphic features on reading (Hartley, 1986), graphical comprehension (Peterson, 1983; Soderston, 1983), and instruction. Certainly, color is one critical feature researchers need to consider.

Research Questions

The following research questions were investigated in this study:

1. Is there a significant interaction among the graphic presentation type (systematically color-coded or black/white), the graphic assessment type (systematically color-coded or black/white), and the time of testing (immediate recall or delayed retention) of verbal material?
2. Is there a significant interaction between the graphic presentation type (systematically color-coded or black/white) and the graphic assessment type (systematically color-coded or black/white) when immediate recall of verbal material is tested?
3. Is there a significant interaction between the graphic presentation type (systematically color-coded or black/white) and the graphic assessment type (systematically color-coded or black/white) when delayed retention of verbal material is tested?
4. Is there a significant difference in recall of verbal material between those given a systematically color-coded graphic presentation and those given a black/white graphic presentation?
5. Is there a significant difference in retention of verbal material between those given a systematically color-coded graphic presentation and those given a black/white graphic presentation?
6. Is there a significant difference in recall of verbal material between those given a systematically color-coded graphic assessment and those given a black/white graphic assessment?

7. Is there a significant difference in retention of verbal material between those given a systematically color-coded graphic assessment and those given a black/white graphic assessment?

Research Design

An analysis of variance for repeated measures was used to test the hypotheses that significant interactions and differences would occur. The independent variables manipulated were the type of graphic presentation (systematically color-coded or black/white), the type of graphic assessment (systematically color-coded or black/white), and the time of testing (immediate recall and 2-week delayed retention). The dependent variable, recall/retention, was measured by achievement on the assessment graphic. The achievement score was the number of characters, actions, and explanations that were remembered and recorded as stated on a graphic presentation summarizing a little-known Norse myth. To accommodate three independent variables, with two levels each, a 2 x 2 x 2 (presentation x assessment x time of testing) was used. Presentation type and assessment type were the between-subjects factors, and recall/retention was the within-subjects factor.

Subjects

The entire seventh-grade class from a Midwest junior high school with 495 students in Grades 7-9 was used in this study. Each of nine seventh-grade homerooms, containing a total of 197 students, was randomly assigned to one of four treatment groups (adjusted $\underline{n}$ = 33).

Treatment Groups

Each of the four treatment groups received one of the following:

1. Color-coded presentation, color-coded assessment
2. Color-coded presentation, black/white assessment
3. Black/white presentation, color-coded assessment
4. Black/white presentation, black/white assessment.

Procedure

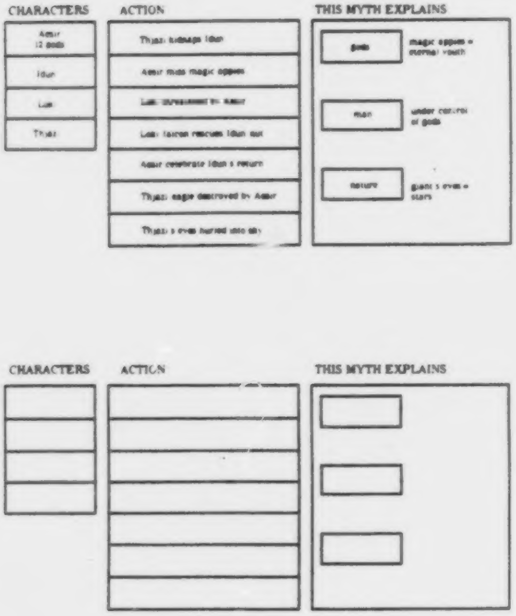
During their homeroom session, all students received directions and listened to the myth via audiotape; they then studied the graphic presentation in isolation. Finally, they demonstrated both immediate recall and 2-week delayed retention on the graphic assessment without the aid of the presentation graphic.

Materials

The packets first distributed to subjects were comprised of an envelope containing a graphic assessment, either color-coded or black/white, with an affixed presentation of an old Norse myth, either color-coded or black/white. Only graphic assessments were distributed 2 weeks later. The graphic design was the same on all presentations and assessments (see Figure 1). The form of the graphic was a unique design created by the researcher to prevent the subjects from having prior experience with the graphic. The systematic color code was explained to all subjects who received color presentations and was selected to create a pattern in the reader's mind:

red was used to code those components of the myth that represented mortal actions; blue was used to code those portions of the myth that represented the actions and plans of the immortals; and yellow was used to code the references to nature in the myth.

Figure 1. Example of presentation and assessment.


CHARACTERS
ACTION
THIS MYTH EXPLAINS
Aesir
12 gods
Idun
Loki
Thjazi
Thjazi kidnaps Idun
Aesir miss magic apples
Loki threatened by Aesir
Loki (falcon) rescues Idun nut
Aesir celebrate Idun's return
Thjazi eagle destroyed by Aesir
Thjazi's eyes hurled into sky
gods
magic apples = eternal youth
man
under control of gods
nature
giant's eyes = stars
CHARACTERS
ACTION
THIS MYTH EXPLAINS

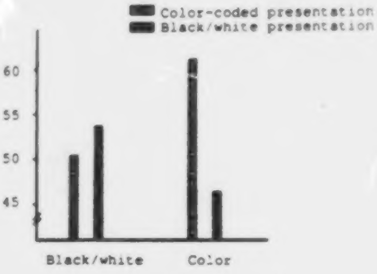
Scoring of the Instrument

All assessments were scored by two raters to ensure accuracy. The range of scores was 0 to 84. One point was given for each correct word or acceptable synonym. One point was given for each box or area where all the words were written in order and spelled correctly. One point was also given for each word or phrase that was placed in the correct box or area.

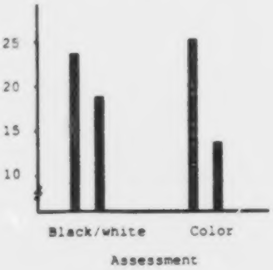
Results

Based on the results of the analysis of variance with the level of significance established at the .05 level, there was a significant three-way interaction among graphic presentation and graphic assessment and time of testing. When time was considered, there was an interaction between the color code used in presentation and the color code used in assessment on the immediate recall of verbal information. This interaction is portrayed graphically in Figure 2. The graphic display of the means and standard deviations for the four treatment groups tested for recall and retention, presented in Table 1, shows that a match in presentation/ assessment type increased immediate recall. However, the nature of the presentation alone apparently had a greater impact on delayed retention.

Figure 2. Three-way interaction of presentation x assessment x time of testing.



Immediate recall



Delayed Retention

Table 1

Mean Performance at Recall and Retention for Each Treatment Group

Group	Time of Testing			
	Recall		Retention	
	M	SD	M	SD
Color presentation				
Color assessment	60.70	(14.09)	25.36	(16.35)
Black/white assessment	50.30	(18.76)	23.79	(20.74)
Black/white presentation				
Color assessment	46.21	(13.43)	13.97	(10.88)
Black/white assessment	53.76	(17.72)	19.00	(15.29)

Note. n = 33 for each group.

Since the presence of a significant three-way interaction suggests the presence of different interactive effects at different levels of one independent variable, simple two-way interactions within each level of testing time were analyzed. Analyses indicated that the source of the three-way interaction was the presence of an interaction between graphic presentation type and graphic assessment type at immediate recall, and the absence of a comparable interaction at the retention test. Additionally, neither of the two-way interactions involved with the variable of time was significant. The interaction of time was significant only in the higher order interaction (see Tables 2 and 3).

Table 2

Mean Performance at Recall and Retention as a Function of Type of Presentation Graphic

	Presentation Type	
	Color	Black/white
Recall	55.50	49.98
Retention	24.58	16.48

Note. n = 66 for each group.

Table 3

Mean Performance at Recall and Retention as a Function of Type of Assessment Graphic

	Assessment Type	
	Color	Black/white
Recall	53.46	52.03
Retention	19.67	21.39

Note. n = 66 for each group.

In order to further investigate the two-way interactions, simple main effects were analyzed using a two-way analysis of variance at each testing interval. Only the variable of presentation type, color-coded and black/white, was significant. The complete analysis of variance summary tables are found in Tables 4 and 5.

Table 4

Analysis of Variance, Tests of Hypotheses for Between Subjects Effects

Source of variation	df	Sum of squares	Mean square	F	Prob.	Sig.
Presentation	1	3054.56	3054.56	7.20	.01	SIG
Assessment	1	1.52	1.52	.00	1.00	NS
Presentation x Assessment	1	2485.23	2485.23	5.86	.02	SIG

Table 5

Repeated Measures Analysis of Variance, MANOVA Test Criteria and Exact F Statistics

	Value	F	Prob.	Sig.
Time x presentation	.99	1.10	.30	NS
Time x assessment	.99	1.65	.20	NS
Time x presentation x assessment	.96	5.32	.02	SIG

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Consequently, there were two major findings of this study:

1. At immediate recall, the important factor in enhancing performance appeared to be the match between graphic presentation and assessment types, rather than the presence or absence of a color code. However, there was a slight overall advantage for having a matched systematic color code in both graphic presentation and assessment.
2. At delayed retention, the important factor in enhancing performance appeared to be the presence of a systematic color code in graphic presentation. The additional presence of a color code in graphic assessment produced a slight advantage.

Recommendations for Practice

Because the match of presentation and assessment type had an impact on the immediate recall of verbal information presented in graphic form and color-coded graphic presentation proved advantageous in later tests, the use of color in graphics should be considered when developing curriculum, planning instruction, and designing text. Designers, teachers, and students must let the purpose of the graphic determine the color code. The code should be thoughtfully created to enhance and extend schema development and fully explained to facilitate learning and retention of verbal material and thereby promote literacy.

Implications for Future Research

To continue this line of research, it is recommended that future study focus on color and graphics:

1. Research should be conducted to investigate how skilled readers use color to remember patterns in schemata. This research should include quantitative, as well as qualitative, ethnographic research and case studies of readers considered to be at an expert level. The results would have implications for the graphic schema strategies we teach to students.
2. Research should include experimentation with both cuing and systematic coding using different colors and varying numbers of colors in graphic background and print to see what impact these variables have on immediate recall and delayed retention.
3. Research should include the use of a color code in other graphic presentations and assessments to see if similar results are produced using a variety of both new and familiar graphic presentations and assessments.
4. Research should include experimentation with the reading of graphics unaided by a listening component to see if similar results are produced with and without a listening activity.
5. Finally, there should be further research into the other features of graphic presentation and assessment to determine the comparative efficacy of other graphic features in tapping and developing schema. This research should indicate whether other features in the graphic design are effective in producing increased immediate recall and delayed retention of verbal material presented in graphic form. The results of further research would provide valuable information for readers, teachers, and designers of curricular materials at all levels of the learning spectrum.

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Visual Aiding: Information When and Where It Is Needed

Helen B. Miller

In the computer business, multimedia is hot. Computer companies view it as a means to enter new markets. Their customers view the multimedia approach as a way to understand complex information and a means to enhance and reduce on the job training. Multimedia consists of multiple media types that affect one of three senses as shown below:

Media Type	Sense
Text	Sight
Graphics	Sight
Animation	Sight
Still video	Sight
Motion Video	Sight
Voice, sound, music	Hearing
Tactile	Feel

Multimedia is multi-sensory; that is, it can deliver messages to more than one sense simultaneously. Multimedia is also technology and tools, some old, some new, and some yet to come. Multi-sensory information delivery, after all, is not a new idea. Educators have been using it for years in the form of slides, video, TV and manipulatives. What is new is the application of multi-sensory information delivery by computers, and specifically, at the "point-of-work," be it the office desktop, the point-of-sale workstation, or the classroom desktop.

NCR Corporation, a subsidiary of AT&T, is pursuing multimedia opportunities in applications and technologies/tools. NCR's Engineering and Manufacturing (E&M) plant in Atlanta, Georgia has begun to investigate how multimedia can be used to better deliver information to their customers. E&M-Atlanta has identified the following success criteria for future information products:

- o Information must be accessible--available when users need it, and where users need it, and as users need it.
- o Information must be comprehensible--both its content and delivery medium carefully selected, designed, and tested to ensure that the information meets user requirements.
- o Information must be cost-effective--1) cannot add significant incremental cost to the product it

supports, 2) cannot negatively impact the Total Cost of Information (TCI), which includes current costs across all development phases, and 3) results in an overall savings to NCR's bottom line. (Miller, Lewis, & Waller, 1991)

A project team was formed to investigate the application of multimedia technology on a retail point-of-sale (POS) workstation. The team consisted of an instructional designer, who was the project lead, a software engineer, a human factors engineer, four information products developers, a graphic designer, and a product manager. The team selected six POS user tasks that met two or more of the following criteria:

1. hardware-related rather than application-specific, therefore, controlled by NCR
2. tasks that NCR customers reported as difficult (as reported by customer service representatives)
3. tasks that were already documented in manuals

The cross-functional team was convinced that multimedia had a great potential as a means to re-direct the current documentation and education development efforts. The team decided to develop modules that contained still image video, graphics and text. The decision was made not to use more advance multimedia options such as motion video and audio because of the hardware restraints of the final product to the customer. The modules were being developed for the NCR 7052 POS workstation and could not add incremental cost to the hardware itself because of the market's sensitivity to price.

In addition the team realized the importance of providing quantifiable proof that visual help modules add value to the POS workstation. The usability study described here includes a systematic investigation on the effectiveness of visual help for six POS tasks.

Purpose of the Usability Testing:

Empirically test the ease of use and quantify the value of the 7052 operations visual help.

Usability Test Questions:

1. Which of the following aiding methods: 1) Text-Only Help, 2) Images, Graphics, and Text Help, 3) Laminated Chart Help, and 4) No Help generally helps the learner efficiently complete six specific POS tasks? The six specific Point of Sale (POS) tasks are: changing receipt paper, changing journal paper, changing ribbon cartridge, inserting and removing a 3 1/2 flex disk, inserting a form into the printer, and scanning a credit card through an integrated or non-integrated MSR.

2. Does user experience level make any difference in the ability to utilize a specific method of help?

Participants:

Forty-three high school students (minimum age 16 years) served as test subjects. Nine of the students participated in the pilot testing phase and thirty-four students participated in the actual test analysis phase. Subjects were either student aides, or members of the Interact Club, or the Key Club. These students agreed to participate in the usability testing to earn an NCR donation to their extra-curricular organization.

Procedure:

The usability testing was conducted at the students' high school during the school day in two rooms set aside for NCR testing. Each testing session was videotaped. Students were tested individually. Before starting, each student completed a demographics questionnaire which included name, age, sex, and previous POS experience. Students were classified as experienced if they had previously changed printer paper on a POS system. All other students were classified inexperienced. Each session had a trained NCR observer who recorded the time to complete task and some behavioral information, but did not assist the student.

Each student, after being classified as experienced or inexperienced, was randomly assigned to one of the following four test conditions:

1. Text-Only Help (TOH),
2. Images, Graphics, and Text help (IGTH),
3. Laminated Chart Help (LCH), or
4. No Help (NH).

The goal was to have five students in each test condition. Table 1 shows the actual make-up of the testing groups.

Table 1. Testing Condition Groups

Test Condition	Experienced	Non-experienced
TOH	4 students	7 students
IGTH	4 students	5 students
LCH	2 students	5 students
NH	1 students	6 students
TOTAL	**11 students**	**23 students**

For two of the test conditions (LCH and NH), the number of students was too small to adequately analyze whether prior POS experience affects the time to complete a POS task. It was also noted that none of the "experienced users" had worked on the NCR 7052 terminal or the NCR 7150 printer. Because of this, experience was eliminated as an experimental variable. Therefore, the analysis shows only the independent variable of test condition. Table 2 shows the revised testing groups.

Table 2 Testing Condition Groups

Test Condition	Students
TOH	11 students
IGTH	9 students
LCH	7 students
NH	7 students
TOTAL	**34 students**

Upon completion of the demographics questions and assignment to a test condition, the observer read the following statement to the student.

> You will be asked to complete six tasks in the shortest amount of time that you can. The object of our testing is to learn how easy people can complete six particular tasks using NCR

> equipment. We would like for you to talk out loud and tell us about what you are doing. We are recording the session on video tape to analyze at a later date. We also will be taking notes on what you are telling us. Remember your input will make a difference on how we design our equipment. We appreciate your time.

Each student attempted to complete six POS tasks:

1. change receipt paper-7150 printer
2. change journal paper-7150 printer
3. change ribbon cartridge-7150 printer
4. insert and remove a 3 1/2" flex disk
5. insert a form into the printer-7150 printer
6. scan a credit card through an integrated MSR.

During the testing, the observers recorded time scores (in minutes) for completion of each task. During pilot testing of the six POS tasks, the observers established average maximum times to complete the tasks. Using this information as a guide, we set time limits for each task. If the student did not complete the task within the specified amount of time the task was labeled as NOT COMPLETE. The six tasks were assigned in random order.

Four test condition descriptions:

Text-Only Help (TOH), Images, Graphics, and Text Help (IGTH), and the Laminated Chart Help (LCH) used a combination of visual and text cues to assist students to perform a specific POS task. The No Help (NH) test condition was the control condition in which the students were asked to perform the task without an aid. Two conditions, TOH and IGTH help, were displayed on a POS 9" CRT VGA monochrome screen with user control. The student accessed the module and the individual tasks within each module through the keyboard. Information was displayed on each screen to inform the student how to exit to the text menu, and step forward or backward through a series of screens by using designated numeric keys on the POS keyboard. The Laminated Chart Help is a two sided card shipped currently with all 7150 printers.

Text-Only Help (TOH):

Once a particular task module was selected, each screen displayed text that described sequential steps for each task. The amount of text information on each screen corresponded exactly to the aiding information displayed on each of the IGTH screens.

Images, Graphics, and Text help (IGTH):

Once a particular task module was selected, each screen displayed two still-video images (photographs) or two graphics (detailed, shaded drawings) with minimal text directions that described sequential steps for each task. The screen resolution was in 640 X480 X 64 shades of gray.

Laminated Chart Help (LCH):

The student was given a two-sided laminated card that contained textual and graphic (detailed, shaded drawing) aid on four of the six tasks. The inserting and removing a flex disk and scanning a credit card through a MSR tasks, were not available on the card, therefore the student was asked to do the final two POS tasks without help.

No Help (NH):

The student was asked to complete the six POS tasks without any help.

Methodology

The videotaped sessions enabled in depth analysis of problem areas and clarification of problem areas in any of the testing conditions. The trained NCR observer recorded time to complete each task and also noted steps that proved particularly difficult. There was a total of five NCR observers. One observer was designated as the lead and was present for all four days of testing. This allowed for any questions to be addressed by the lead observer so that consistency could be maintained.

There were time limits for each task completion:

1. change receipt paper--15 minutes,
2. change journal paper--15 minutes,
3. change ribbon cartridge--10 minutes,
4. insert and remove a 3 1/2"flex disk--5 minutes,
5. insert a form into the printer--5 minutes, and
6. scan a credit card through an integrated MSR--5 minutes.

If the student was not able to finish the task in the allowed time, the task was recorded as NOT COMPLETE.

Results of the Analysis of Data

The purpose of analyzing the data was to determine whether the test conditions affect the time to complete tasks in the same way. Statistical analysis determines if the relationship is based on chance or on significant differences between and/or within groups. Our expectation was that the IGTH would have a significant benefit (reduced time to complete task) for all students.

Means for each test condition on the six POS tasks were calculated. Only times labeled as complete (within the allowed time) were used in the calculations. Table 3 depicts the mean scores for each task under each condition and identifies the actual number of students in each group. Table 3 also indicates the total percent of students completing the POS tasks under each test condition.

Table 3. Mean scores, number of students completing POS tasks and total % of students completing tasks in each condition.

POS Task	IGTH (9) M (N)	TOH (11) M (N)	LCH (7) M (N)	NH (7) M (N)	Total % of completion
Receipt	2:37 (9)	4:03 (10)	3:15 (6)	3:16 (6)	91%
Journal	8:42 (3)	7:09 (4)	8:29 (4)	9:07 (3)	41%
Ribbon	4.28 (8)	5:42 (9)	2:54 (7)	3:21 (6)	88%
Disk	1:07 (9)	1:20 (9)		**1:23 (9)	79%
Form	1:17 (9)	2:03 (10)	1:12 (7)	1:02 (6)	94%
MSR	0:27 (9)	0:58 (11)		**0:56(14)	100

** LCH and NH are averaged scores since both conditions were no help.

Six one-way anovas (analysis of variance) were performed to analyze the data for each of the six POS tasks. The anova is a statistical technique that investigates the differences between or among mean scores. The independent variable was the test condition (between) for each of the six POS tasks. The dependent variable was Time to Complete Task (TCT) and a alpha level of .05 was selected. The results showed no significant differences between the four types of conditions and time to complete each POS task. A summary table for each of the six anovas is presented.

Table 4. Analysis of Variance Summaries for each of the POS Tasks

Source	N	df	Sum of Squares	Mean Square	F	Signif of F
Receipt						
Condition	31	3	35327.80	11775.94	.83	.48
Within		27	381806.40	14140.98		
Journal						
Condition	14	3	28409.52	9469.84	.32	.81
Within		10	296838.83	29683.88		
Ribbon						
Condition	30	3	133771.93	44590.64	2.15	.12
Within		26	538695.94	20719.07		
Disk						
Condition	27	3	1684.81	561.60	.31	.82
Within		23	41547.19	1806.40		
Form						
Condition	32	3	19116.41	6372.14	2.61	.07
Within		28	68297.09	2439.18		
MSR						
Condition	34	3	16039.91	5346.64	2.38	.09
Within		30	67549.07	2251.64		

Discussion:

This usability study sought to evaluate the usage of visual help for performing operations on a 7052 terminal and 7150 printer. We assumed that the IGTH condition would significantly improve time to complete the six tasks for users as compared to the three other test conditions. The results indicated that a particular help condition did not improve performance. In other words, the differences among the mean scores (time to complete tasks) were not varied enough to indicate that any test condition was superior to another test condition. The results of the anovas can be questioned because the group size under each condition was very small. This reduction was due in part to the elimination of some subjects' scores because a particular task was not completed in the allowed time. Another issue is the similarity between the LCH condition and the IGTH condition. Both conditions supported images (either photographs or detailed, shaded drawings) and text help but one was delivered on a laminated chart and the other on a 9" VGA CRT monitor.

With these suspect results it is important to inspect the mean scores. The IGTH took less time on three out of the six POS tasks; receipt, disk, and the MSR. The three other test conditions indicated less time each for one particular task; TOH--journal task, LCH--ribbon task, and NH--form task. The mean scores also indicate that in four out of the six tasks that visual/text information was superior to a no help or text-only help. This seems to indicate the advantage of a visual help system.

Research in visual help (Dwyer & Dwyer, 1989, Holliday, 1975 and Winn, 1987) has consistently shown that visual instructional media is beneficial in aiding learners' comprehension and memory, therefore, the results of this study were disconcerting. We decided to look at the design of the six modules and locate possible design problem areas in the visual help and also possible design problems in the 7150 printer itself. We started by reviewing the videotapes of the test conditions. All observers' notes were re-examined to locate design problem areas. After pinpointing trouble spots, five reviewers from the project team re-examined the modules and made recommendations. A member of the NCR HITC cognitive engineering group will also critique the visual help. Expert times to complete the six POS tasks were also calculated. At this point in the analysis several recommendations are suggested for improvements in the visual help and also for setting the criteria for usability.

Recommendations and Summary:

The recommendations are for the IGTH condition. The reason is that NCR, in particular, E&M Atlanta, is doing extensive product development work in embedded training systems which promote the use of visual help as a complement to or a replacement of text for on-line help systems.

1. Modify images in several of the modules. The original images were produced by using a digital still video camera that produced full-color images. These images, when reduced in size and color (240

colors to 64 shades of gray), lost clarity in their message to the user. For example, in the ribbon changing module, the 240-color image on a 14" monitor shows clearly how the ribbon slides between the metal guide and the printer head. Yet when shown in 64 shades and on a 9" monitor, this crucial step cannot be seen easily.

2. Change the text in approximately 17 steps. Many of the text changes correct inconsistent of word usage. For example, using the word "lift" when the word "open" is more accurate. Changes were also suggested that would focus the text to support the action the image was depicting rather than just reiterate the image. Text and images need to compliment rather than duplicate each other. For example, "Insert take-up reel by pressing both ends." would be replaced with "Snap take-up reel in between black wheels." The image shows the operator pressing the ends to insert. The new text would focus on the auditory cue which is the "snap" sound and visual cue for placement of the reel between the two black wheels not shown.

3. Enhance two of the graphics modules with animation. Each task the user to move an object in one continual motor motion rather than separate concise steps, making these short modules very appropriate for animation. Animation would quickly demonstrate the needed action to the user.

The next reiteration of visual help had to set usability criteria. To set reasonable criteria it was necessary to determine not only average novice times but also average expert times to complete each of the six POS tasks. The novice averages were calculated from the usability testing. The expert averages were calculated by recording experienced high school interns at the plant who were trained on the 7150 printer (journal, receipt, and ribbon) and plant engineers who were experienced on the MSR, disk, and form insertion tasks. Once the expert times were calculated, the time goals were set. The time goal for the novice on their first attempt is 75% longer than the expert's time. The time goal for second attempt is only 50% longer than the expert time.

The jump to only 50% longer indicates the importance of repeat performance and visual help. Often a new learner takes time just to orient to the task (interpreting how to interact with the help system instead of just being able to learn how to complete a certain task). For example, knowing how to move from one image to another. This in itself increases time. To validate the visual help, the time criteria should focus on the operators' second or third time attempt on a task. The question then centers more on, does visual help aid the ability to perform a task.

The importance of the revisions cannot be underestimated. NCR need conclusive data to support goals of developing visual help systems. Key to the success of NCR's next generation retail products will be improvements that help retailers manage a shrinking labor pool, high turnover, and workforce illiteracy. NCR feels strongly that easily-accessed visual aids will meet these needs and demonstrate NCR's understanding of the markets where it does business.

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The Effect of Varying Visual Activites to Impact Cognitive Processing and the Achievement of Educational Objectives

L. Bennett

Traditional American educational programs have consisted of an instructor who provides the principal instructional content for a class of students. However, as we begin to set goals on the design of educational programs for the twenty-first century, further con-sideration of critical thinking strat-egies becomes even more critical. Individuals who are capable of critical thinking and competent at recalling information will be able to face the challenges of the twenty-first century (Tentenbaum and Mulkeen, 1986). It has been noted that develop-mental and individual differences in content knowledge have a significant impact upon cog-nition; furthermore, educational systems must prepare their charges for the future by providing them with the broad-based knowledge they will need to participate in a highly technical and global world (Schneider, Korkel, and Weinert, 1990, p.235).

The process of learning is an active, constructive process whereby learners generate meaningful information by accessing and applying existing knowledge struc-tures (prior knowledge) to the new learning situation or problem to be solved. The generative hypothesis (Wittrock, 1978) asserts that meaning gained by activating and altering existing knowledge struc-tures in order to interpret what is presented. Generative learning activities are those that require learners consciously and intentionally to relate new information to their existing knowledge, rather than responding to material with-out using personal, contextual knowledge (Jonassen, 1988), for example, by merely outlining and underlining. In these activities, in-formation is transformed, inte-grated, and elaborated into a more personal form that is more mem-orable to the learner. Varied inter-active visuals (ones that require the learner to draw or trace parts of the visual to complete an illus-tration) have been the focus of this research project; they can also be defined as generative learning strategies. Learning strategies which are intended to increase the number of links between presented information and existing know-ledge structures enable the learner to perform in a generative manner. Varied interactive visuals can have significant instructional benefits for students by allowing them to select and acquire information actively for cognitive processing (Bennett, in press).

This study attempts to enlighten the present literature within the field of instructional systems basically, the use of visuals for instructional purposes. Educators are encourage to design material which allows active processing and integration of information. Varied interactive visuals offer the opportunity for educators to design material that encourages active processing by allowing the learner the opportunity to interact with the lesson on a variety of levels (Bennett, in press). Varied interactive visuals are generative learning strategies which allow the learner to select, construct, and acquire information actively (Bennett, in press). Therefore, the learner is given the opportunity to rehearse and practice a concept actively, leading to greater information processing. This paper will review the following research question which is part of a larger study conducted in the Fall of 1990 at The Pennsylvania State University.

Hypothesis Statement

There will be no significant difference in achievement among students in the four treatment groups (Control, Visual Tracing, Visual Drawing and Visual with Feedback) on tests designed to measure different educational objectives.

Research Question

Do varied interactive visuals differentially affect the instructional performance of learners on achievement of different educational objectives?

Method

The instructional unit dealing with the physiology and functions of the human heart (2000 words) was used in the study as it was originally designed by Dwyer and Lamberski (1977). This basic unit was transformed into four (2,000) word) instructional treatments possessing different levels of interactive visuals. The variation in the interactive visuals ranged from completed illustrations to incomplete visual outlines. This study was conducted in the Fall of 1990.

Subjects

Students from Special Education 400, a course for general education majors in the College of Education at the University Park Campus of The Pennsylvania State University, participated in the study, 178 total. The students were initially given a pretest consisting of 36 items based on the basic physiology of the human body in order to differentiate among high, medium, and low prior knowledge levels. The students were then randomly assigned to one of the four treatment groups. Each test sheet was coded and tracked throughout the study.

Materials

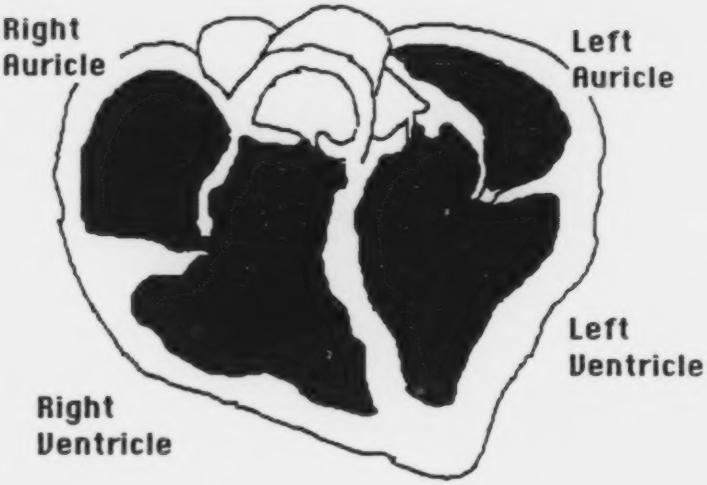
Four interactive visuals were used for this study, the control treatment consisted of an exact replication of the original instructional booklet. These visuals allowed the learner to scan and interact with all of the visual information provided to complement the verbal instruction. The second treatment consisted of the original instructional text plus illustrations which provide the learner with the opportunity to trace dotted lines emphasizing the shape and the location of critical information presented in the text passage. The third treatment presented the learner with a simple valentine shape and directions to compete the heart drawing by drawing specific parts as they were described and located in the text. The fourth treatment consisted of the simple valentine shape and directions to complete the heart drawing, to coincide with the text as with Treatment 3; however, corrective feedback was introduced as a simple line drawing following the drawing activities to support the context. Figures 1, 2, 3, & 4 depict the visuals used for each treatment.

Dependent Variables

The posttest format consisted of a drawing test with three separate 20-item multiple-choice criterion test originally designed by Dwyer (1978). The drawing test required the students to draw a representative diagram of the heart and place the numbers of the tested parts in their respective positions. The multiple choice tests consisted of a identification, terminology and comprehension section. The identification test required students to identify the numbered parts on a detailed drawing of the heart. The terminology test was designed to measure knowledge of specific facts, terms, and definitions. The comprehension test requires the the students have a thorough understanding of the heart, its parts, its internal functioning, and the simultaneous processes occurring during the systolic and diastolic phases.

Experimental Procedures

Four time slots were set so that students could participate in the study. The results of the 36-item multiple choice pretest on the basic physiology of the human body was used to place students into one of three sub-groups, high, medium or low prior knowledge levels. The raw score range of the students can be described as follows: high scores 30-24; medium scores, 23-21; and low scores, 20-15. Since the students were required to place a four digit tracking code on their test sheets, this number was used to assign them to one of the four treatments based on their pretest performance. The study was conducted on three consecutive evenings. During this time the students were given a list of four digit codes to determine which treatment they had been assigned to. This was done to insure confidentiality. When the students turned in completed instructional booklets they were given the post-test consisting of both the drawing and multiple-choice sections.


Right Auricle
Left Auricle
Left Ventricle
Right Ventricle

Each half of the heart is divided into an upper chamber and a lower chamber. The upper chambers on each side of the septum are called auricles; the lower chambers are called ventricles. Auricles have thin walls and act as receiving rooms for the blood, while the ventricles having thicker walls act as pumps moving the blood away from the heart. Although there is no direct communication between the right and left sides, both sides function simultaneously.

Figure 1. Sample of the interactive visual contained in Treatment One (T1), page 6.

Each half of the heart is divided into an upper chamber and a lower chamber. The upper chambers on each side of the septum are called auricles; the lower chambers are called ventricles. Auricles have thin walls and act as receiving rooms for the blood, while the ventricles having thicker walls act as pumps moving the blood away from the heart. Although there is no direct communication between the right and left sides, both sides function simultaneously.

Directions:
Trace the dotted lines and then label the four chambers of the heart, on the blanks provided.

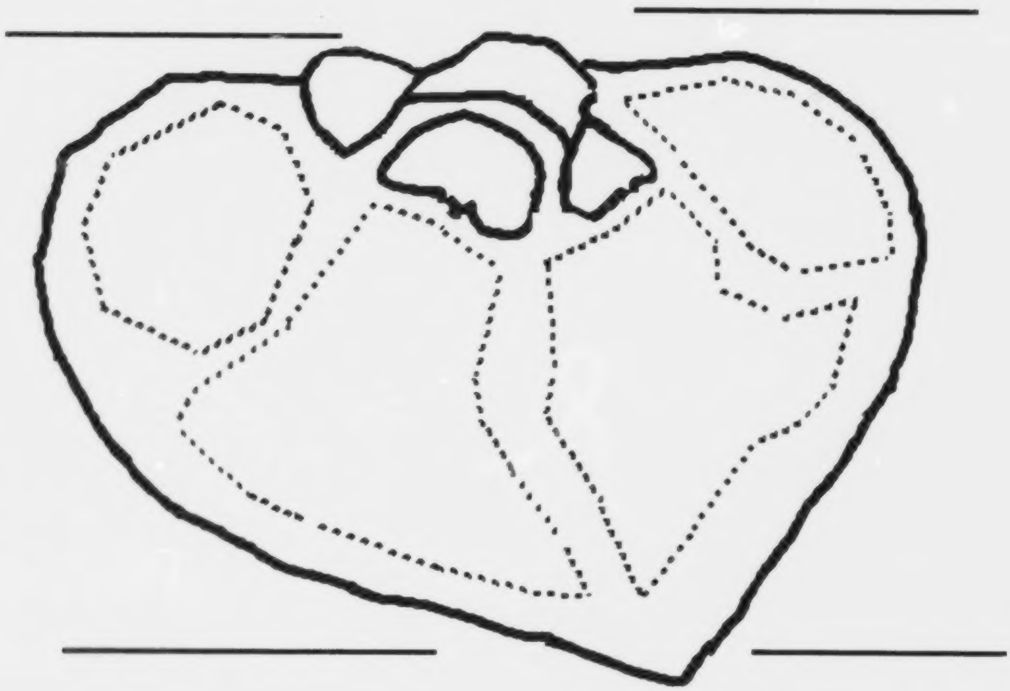


Figure 2. Sample of the interactive visual contained in Treatment Two (T2), page 6.

Each half of the heart is divided into an upper chamber and a lower chamber. The upper chambers on each side of the septum are called auricles; the lower chambers are called ventricles. Auricles have thin walls and act as receiving rooms for the blood, while the ventricles having thicker walls act as pumps moving the blood away from the heart. Although there is no direct communication between the right and left sides, both sides function simultaneously.

Directions:
On the provided diagram of the heart draw and label the 4 chambers.

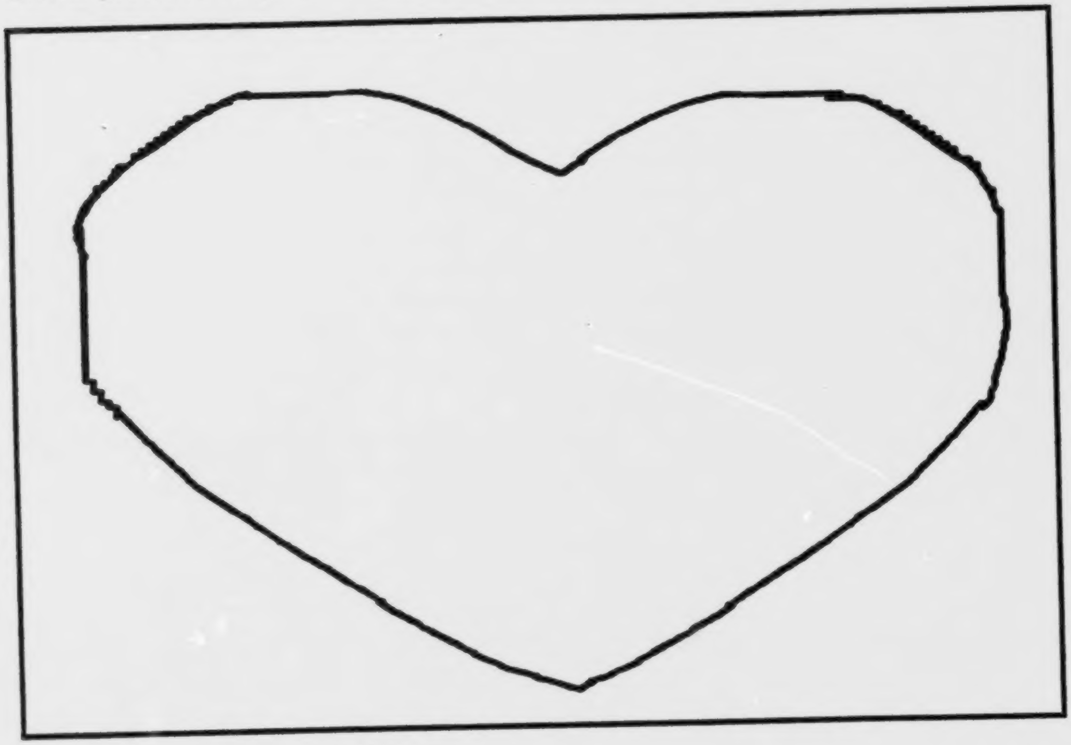
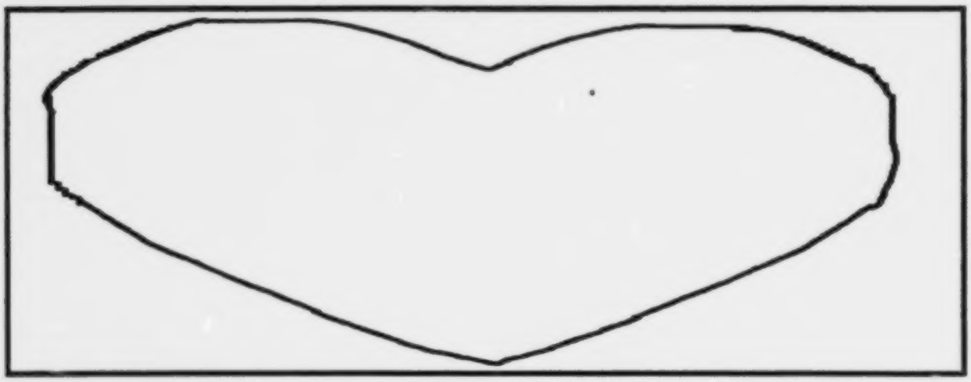


Figure 3. Sample of the interactive visual contained in Treatment Three (T3), page 6.

Each half of the heart is divided into an upper chamber and a lower chamber. The upper chambers on each side of the septum are called auricles; the lower chambers are called ventricles. Auricles have thin walls and act as receiving rooms for the blood, while the ventricles having thicker walls act as pumps moving the blood away from the heart. Although there is no direct communication between the right and left sides, both sides function simultaneously.

Directions:
On the provided diagram of the heart draw and label the 4 chambers.



Now compare your illustration to ours.

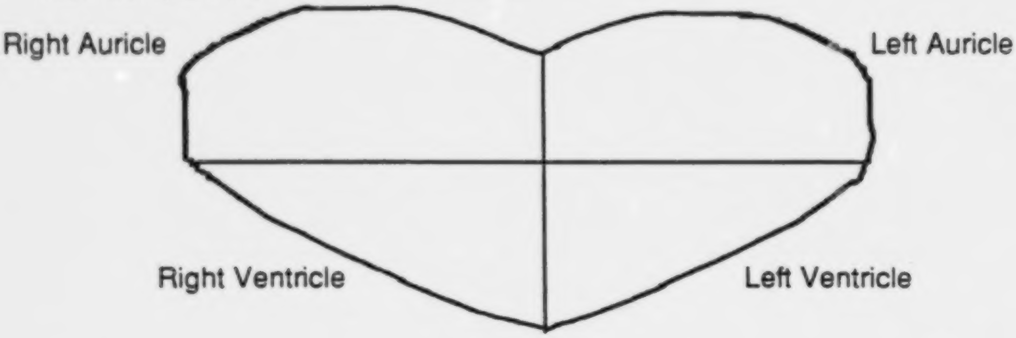


Figure 4. Sample of the interactive visual contained in Treatment Four (T4), page 6

The analysis of the test sheets was conducted by the Penn State College of Education Instruc-tional Support Center. The center provided descriptive and infer-ential data of the test sheets. The data sets collected from this study were analyzed using the MYSTAT statistical program for the Mac-intosh. The alpha level of sig-nificance for all comparisons was set at .05 level. The omnibus F-Test in an analysis of variance (ANOVA) was used to test the hypothesis that the population means of all J groups (Treatments 1-4) are equal. The Tukey Q statistic was used to follow up the analysis.

Results

An analysis of variance was conducted to determine differences in student achievement among the four treatments for the criterion measures: drawing, terminology, identification, comprehension, and total test. The following reliability coefficients (KR-20) have been recorded for each of this study's criteria: 0.83 drawing, 0.83 termi-nology, 0.80 identification, 0.80 comprehension, and 0.94 total test score. The results of the analysis of variance revealed insignificant differences on all criterion measures except for the drawing test (F=3.45, df=3/174, p<.05). Table 1 presents the analysis of variance for each criterion measure among the four treatments. The drawing test re-quired the learners to complete construction of a simple illustration of the heart and to position all the numbered parts in their relative positions.

A follow-up test was then conducted to determine which treatment was most effected in facilitating student achievement on the drawing test. Table 2 presents the follow-up results among the four treatments. The results of the Tukey's Q procedure revealed significant differences between Treatments 4 and 3 on the drawing task. Treatment 4 consisted of a simple valentine shape which required the learner to read the text and to then complete the illustration. Feedback was also provided in the manner of a simple line sketch at the bottom of the page. The students were instructed to read the text, complete the illustration and then to review the feedback. The feedback could only be viewed once the lower half of the page was unfolded. This activity provided the learner with corrective feedback. This also provided the learner with a comparison and review of their illustrations with that of the lesson. Treatment 3 consisted of a simple valentine shape which required the learner to read the text and then to complete the illustration. There-fore, the varied interactive visuals with feedback was more effective than the varied interactive visual presentation consisting of a heart-shape sketch only (Treatment 4 > 3, Tukey Q = 4.18 > 3.69 Critical Q, p>.05). Therefore, this research hypothesis which states that their will be no significant differences in achievement among students in the four treatment groups on tests designed to measure different educational objectives was rejected.

Table 1

Analysis of Variance of Student Achievement Among the Four Treatments on Each Criterion Measure

Analysis of Variance of Student Achievement Among the Four Treatments on Each Criterion Measure

Drawing

Source	Sum- of- Squares	DF	Mean-Square	F-ratio	P
Treatment	191.21	3	63.74	3.45*	0.018
Error	3217.04	174	18.51		

Terminology

Source	Sum- of- Squares	DF	Mean-Square	F-ratio	P
Treatment	44.94	3	14.98	0.65	0.581
Error	3983.51	174	22.89		

Identification

Source	Sum- of- Squares	DF	Mean-Square	F-ratio	P
Treatment	91.22	3	30.41	2.01	0.115
Error	2637.51	174	15.16		

Comprehension

Source	Sum- of- Squares	DF	Mean-Square	F-ratio	P
Treatment	61.35	3	20.45	0.93	0.429
Error	3836.607	174	22.049		

Total Criterion Posttest

Source	Sum- of- Squares	DF	Mean-Square	F-ratio	P
Treatment	358.41	3	119.47	0.51	0.676
Error	40805.18	174	234.51		

* significant at the .05 level

Table 2
The Tukey Follow-up Test of Student Achievement on the Drawing Test for Treatmens 1-4

The Tukey Follow-up Test of Student Achievement on the drawing Test for

Treatments 1-4

Treatment Comparisons	Confidence Intervals		Tukey's Q Statistics	
4 - 3	(.28 *	5.05)	4.18 > 3.69 *	4 > 3
4 - 2	(-.13	4.37)	3.53 < 3.69	4 < 2
4 - 1	(-.62	4.08)	2.74 < 3.69	4 < 1
1 - 3	(-1.60	3.48)	1.37 < 3.69	1 < 3
1 - 2	(-2.03	2.80)	.60 < 3.69	1 < 2
2 - 3	(-1.90	2.99)	.83 < 3.69	2 < 3

Note: Tukey's Critical Q = 3.69 (4,120)

1 = Visual Illustration
2 = Visual Illustration requiring tracing
3 = Visual Illustration requiring drawing
4 = Visual Illustration requiring drawing with supportive feedback

* significant at the .05 level

Discussion

The amount of learning that occurs during reading is influenced by several factors, such as the reader's prior knowledge level, the nature of the text, and the reader's goals and strategies (Just & Carpenter, 1987, p.401). Learning is active constructive process initiated by the learner to process incoming information (Bennett, in press). Learning is an a cumulative process which builds upon the learners prior knowledge schemata. Therefore, learning patterns can be repeated which greatly affect the learner's ability to perform in response to the environment. In addition to the structure and the character of the new knowledge or skill involved, learning is affected most by an individual's general information processing, learning skills, habits, previously acquired knowledge and skills related to that to be learned (Butler, 1985, p. 12). This has been the premise of this research Hypotheses and question. Do the interactive visuals affect the students' achievement or ability to process information irrespective of their prior knowledge levels? The results indicate that for Treatments 3 and 4 students' achievement or ability to process information can be affected by the treatment presentation. This dis-crepancy can be related to the students interaction with the visual activity (time spent reviewing, constructing and processing the visual illustration) (Bennett, in press). The learners within treat-ment 3 spent more time reviewing the text in order to complete the visual drawing activity. Treatment 4 provided the learners with corrective feedback on the correctness or incorrectness of the visual drawn (Bennett, in press). Differences between treatments related to the drawing measure can be related to feedback. Feedback in this form provided the learner with a schematic pattern by which corrections or reinforcement could be made possible. This schematic model of the heart influences the construction of information for processing. Therefore, Treatment 4 was more significant than Treat-ment 3 on the drawing section of the dependent measures test. However, the following conclusions can be made based on this study first, the use of varied interactive visuals to complement contextual information does not automatically improve student achievement of all types of educational objectives. Secondly, increased interaction with content material does not, in itself, guarantee increased information processing and subsequent increases in achievement.

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The Perception of Biological Concepts Through Story Animated Movies

Ora Silverstein
Pinhas Tamir

1. INTRODUCTION

It is well known that spontaneous television viewing has a crucial effect on learning. In the USA an average schoolchild watches between 15,000-16,000 hours of television per year, and spends 13,000 hours at school. In Israel 73% of 15-16 year olds watch television 2-4 hours per day (our research, 1990).

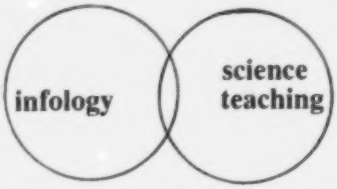
Substantial learning may take place through watching television (Pettersson, 1988). A television code - the animated movie - has grown up in recent years and is watched extensively. It has developed from the still cartoon to animated movie, a drawing projected at a uniform speed making animated objects come to life on the screen. Animation symbols to which Pettersson refers as "entertainment graphics" (1988), developed in a number of directions. Several specific groups can be distinguished as it can be seen hereafter, which call for serious thought. This research deals with nonmoderated viewing of animated biology movies.

We refer to the code studied in the present research as "story animation". In it, the television message is conveyed by means of dramatized animated figures not identical to the existing reality. Broadcasts in the documentary code served as a study control. In these documentary broadcasts, real life pictures are integrated with animated sequences which we shall call "descriptive animation". This animation gives an abstract schematic representation of the real thing.

For the purpose of this study it is important to distinguish between animism - the tendency to see objects as living things - and animation which expresses a visual code. But the etymological source common to the two concepts - **animare** - "to endow with breath and life" should be borne in mind, since the research presented here examines the viewer's translation of the story animation code.

The concept of animism was discussed by Piaget (1929) who maintained that children up to the age of 12 conceive of inanimate objects as having feeling and awareness. This phenomenon declines with age. According to Piaget it should not be confused with anthropomorphism which attributes human reasoning and emotional and purposeful desires to non-humans. It is also important to distinguish between anthropomorphism and teleology. Teleology is a way of reasoning whereby biological phenomena are explained in terms of purpose and intention.

The research presented examines media literacy, namely the ability of viewers to translate a message by viewing a given television code. It assesses knowledge gain and attitudes resulting from spontaneous viewing of biological concepts dealing with the human body and the living cell, presented in story animated code. It also studies misconceptions which may arise from such viewing. Thus, it occupies an area shared by science teaching and infology:



Anthropomorphism (Jungwirth 1979), use of teleological explanation (Tamir 1985) and difficulties in understanding the living cell (Dreyfus and Jungwirth, 1987), were found among 15-16 year old schoolchildren. Noble (1976) claims that 13 to 15 year olds are capable of picking up the right message from any visual medium code. Hence, our study examines a population aged 15-16 on the assumption that this age group will by now have left behind the animistic way of thinking. Thus anthropomorphic approaches to biological concepts in the message viewed should be recognized as misconceptions.

2. BACKGROUND

The study was carried out in Israel. On February 14th, 1989 Israeli Educational TV started broadcasting Albert Barille's "Il etait une fois la vie" - "Life" produced in France, a 26-part series of story animated programs on the living cell and the human body. The series presents basic subjects and concepts included in the biology curriculum in Israeli schools, by means of dramatized animated figures portraying cells, organs and substances. Every program deals with an organ, a system or a process in the human body.

It was decided to broadcast the series dubbed in Hebrew during afterschool hours. The special code of the series and the importance of the biological concepts it presents raised questions both on the part of the producer of the Hebrew version, and on the part of science educators who felt that the series should be carefully examined before it was broadcast.

The Hebrew version of "La Vie"* was carefully prepared to avoid errors that might lead to misconceptions among viewers in general, including the study subjects. Errors in message or incompatability between code and message would have impaired study effectiveness. A Hebrew sound track was prepared with some additional explanatory passages of narration.

3. HYPOTHESES

Ho^1: Non-guided viewing of story animated broadcasts will lead to a knowledge gain by 10th Grade students. This knowledge gain will be lower than that achieved by viewing documentary broadcasts.

Ho^2: Compared with viewing documentary broadcasts, viewing story animated broadcasts will cause misconceptions: the frequency of causal explanations will decline, teleological and anthropomirphic explanations will increase.

** As Science Consultant to Israel's Instructional Television network at the time, Ms. Silverstein was involved in the preparation and presentation of the Hebrew version.*

Ho^{3}: Additional exposure to animated programs prior to the experiment will cause a greater rise in anthropomorphic and teleological explanation than the absence of such exposure.

Ho^{4}: Student's attitudes towards story animation broadcasts will be more positive than towards documentaries.

Ho^{5}: Non-guided viewing of story animated broadcasts will raise knowledge gain, lead to even more positive attitudes and greater frequency of teleological and anthropomorphic explanations among technical school students compared with academic schools.

Ho^{6}: Teachers' attitudes will be more positive towards documentary broadcasts than towards the story animation broadcasts.

4. METHOD AND INSTRUMENTS

4.1 Broadcasts

Broadcasts in Code A - story animation code:

The first two programs of the "La Vie" series were selected for the study: "The cell" and "From Fertilization to Birth", since these incorporate the basic biological concepts given in the series.

Broadcasts in Code B - documentary code:

To test the hypotheses the study was based on a comparative viewing of animated programs and documentaries, which were as similar as possible in message (same subjects and concepts) and running time, and had a Hebrew sound track (not subtitles). Table 1 presents the features of these broadcasts.

TABLE 1: The broadcasts used in the study

SUBJECT	STORY ANIMATION		DOCUMENTARIES	
	Title	Running time	Title	Running time
The cell	The Cell	26 min.	What is life The living cell	9 min. 18 min. 27 min.
From fertilization to birth	Childbirth	26 min.	New life D.N.A.	15 min. 11 min. 11 min. 26 min.

4.2 Tests and questionnaires prepared

Tests and questionnaires were designed on the basis of content analysis of the broadcasts. The results of the content analysis were validated by experts.

The main biological concepts in the first two broadcasts in both codes used are as follows:

In "**The Cell**": the living cell, nutrition, genetic information, chromosomes, cell nucleus, mitochondria, oxygen, breathing, enzyme, cell membrane, organs, energy, cell size, sugars, fats, red blood corpuscles, white blood corpuscles, ribosomes.

In "**From Fertilization to Birth**": the living cell, ovum, sperm, fertilized ovum, embryo, proteins, genetic code, chromosomes, sex chromosomes, D.N.A., R.N.A., enzymes, mitosis (cell division), pregnancy, red blood corpuscle, cell size, breathing, oxygen, different cells, tissues, organs.

Table 2 presents tests and questionnaires prepared for the study. Figure 1 presents the series' characters.

5. SUBJECTS

Population

a. Grade 10 pupils in urban schools, central Israel
b. Biology teachers in Israel.

Pupils sample: 32 randomly selected 10th grade classes, totaling about 800 students.

Sub-groups: Half the sample were academic high school students who had taken biology in 9th grade and continued with it in 10th grade. The other half were students at technical high schools where biology is not of the subjects included in the 10th Grade curriculum.

Teachers sample: An attitude questionnaire was sent to 20% of the biology teachers in Israel. Every 5th name in the official list of biology teachers was included in the sample.

6. PROCEDURE

The two equal-sized groups - academic high school students and technical school students - were tested on the two subjects chosen for the study, i.e. "The Cell", and "From Fertilization to Birth". Each group was sub-divided for study purposes in two, one sub-group to view the story animation code broadcast, the other to view the documentary code broadcasts. In all, there were 8 test groups.

The broadcasts selected were copied onto video cassettes and shown in school classrooms on color TV, without any guidance.

The experiment was conducted in two consecutive years. In 1989, the subjects had not previously been exposed to story animation in the "La Vie" series.

In research year two, 1990, the test procedure was the same, but this time the study subjects had already been exposed to the series.

The length of the experiment was four hours.

Students and teachers were later interviewed personally and group discussions with students were recorded (see fig. 2).

7. DATA ANALYSIS

The study is now in the final stages of data analysis. Some data, including findings for Ho^3, Ho^5, and personal questionnaires, are not yet ready for presentation.

For Ho^4, (table 3) dependent variable knowledge gain was checked against independent variables code types. Test 1 was used in which the highest possible score is 5 points. Statistical comparison of the mean scores of dependent samples by t test was carried out for each code separately to compare knowledge gain in the two different codes.

TABLE 2: Tests & attitude questionnaires used in the study

Ques.	Title	Tests and Questionnaires	Target pop.	No.of items	Reliability
1	The Cell-General knowledge	Open questions to examine knowledege of the cell and . its division	Stud.	10	0.75
2	The Cell-Antropomorphic	Multiple choice test examining the use of teleological vs. causal explanations; students asked to give reasons for choice.	Stud.	9	(A) 0.66 (I) 0.62
3	From Fertilization to Birth - Antropomorphic	Multiple-choice questions test examining the use of teleological vs. causal explanations; student asked to give reasons for choice	Stud.	13	(A) 0.60 (I) 0.82
4	Attitudes - documentary	Likert scale, examining attitudes of students who viewed documentaries.	Stud.	13	0.72
5	Attitudes - animation	Likert scale, examining attitudes of students who viewed story animation.	Stud.	16	0.77
6	Teachers attitudes	Likert scale: Part A: attitudes to the TV medium. Part B - attitudes to story animation vs. documentaries.	Teach.	28	0.90

Reliability levels of tests & questionnaires according to Cronbach using alpha coefficient.
(A) - Scores reflecting correct causal answers.
(I) - Product scores for correct answers together with argument.

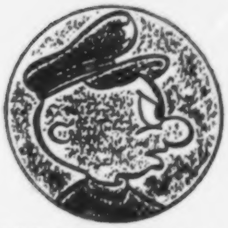
The animated key figures in the series:

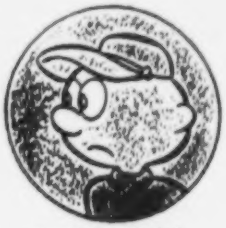
FIG. 1:

A. In the human body: (1) cells, (2) substances, (3) micro-organisms.

B. people: the cnildren, the mother.

C. an abstract enitity - the wise old man - scientist and the boss.


Officer Enzyme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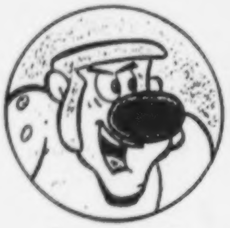
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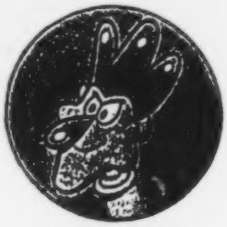
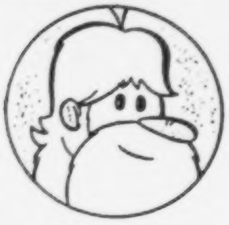
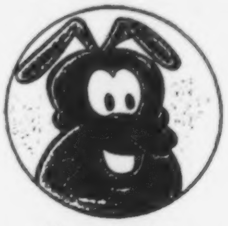
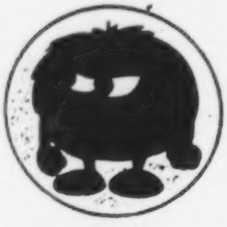
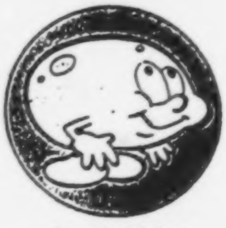
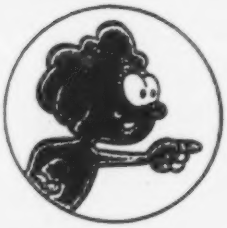

Virus

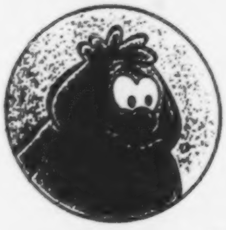

Big Boss


Mr. globe


Dust


O_2 Bubbles


Globin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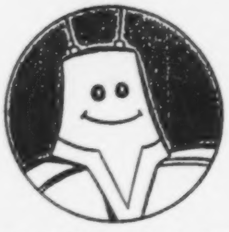
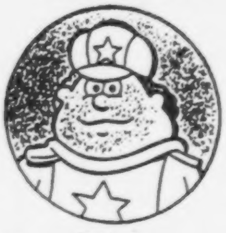
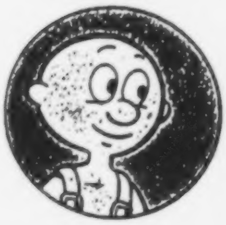
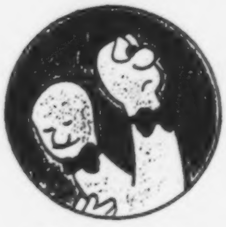
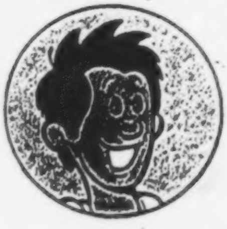
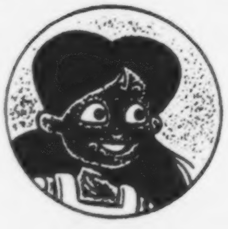

Metro-Antibody Leader

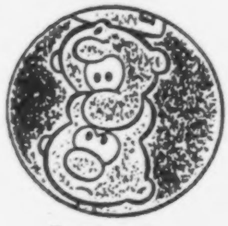

Fatso

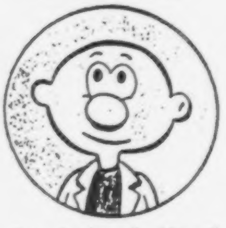

Enzyme

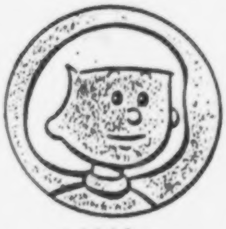

Chromosome

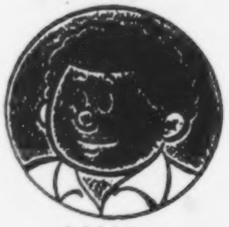

Pierrot


Pssy


Part of
D.N.A


Assistant Head

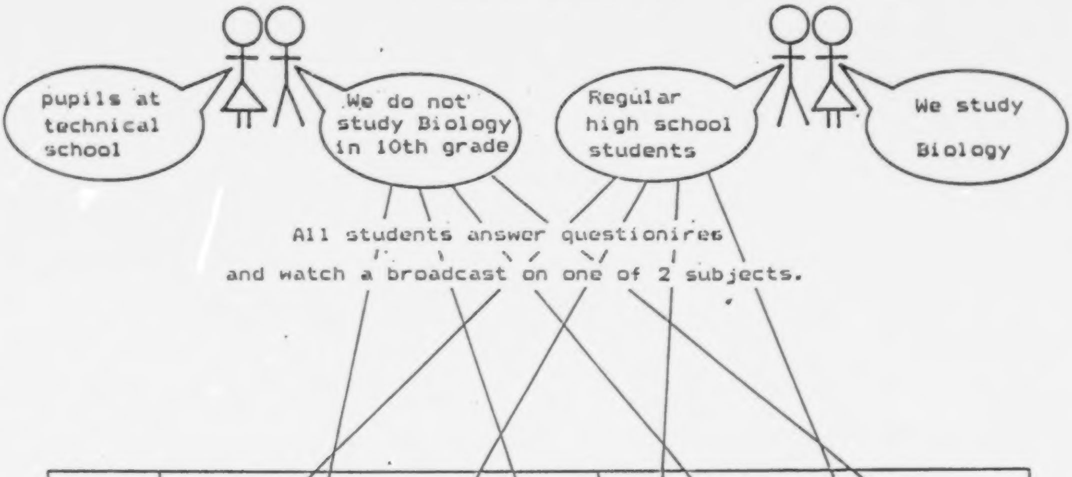

Little
Pierrette


Little
Pierrot

Screening Story animation broadcasts

FIG. 2:

student population
10th grade students
of the central area


pupils at technical school
We do not study Biology in 10th grade
Regular high school students
We study Biology
All students answer questionires and watch a broadcast on one of 2 subjects.

Subject	The cell				From fertilization to birth			
code	documentation		animation		documentation		animation	
students	Regular	Technical	Regular	Technical	Regular	Technical	Regular	Technical

The student within the study sample devoted about 4 hours to answering questioniers and screening. 2 meetings in the same week. An interviewd student devoted an additional hour.

◯	◀●	◉	
Answering tests before viewing	Viewing broadcast (26 min.)	Answering tests and questioniers after viewing	Possibility of group discussion personal interview

Pre-test	Post-test
one of (1) The cell - general knowledge (2) The cell - general knowledge	The same knowledge test
one of (3) The cell - antrophmorphic (4) Birth - antrophmorphic	The same antrophmorphic test
	(5) Personal data
	one of (6) Attitudes documentary (7) Attitudes animation

For Ho^{2}, (table 4) anthropomorphic tests marked 2 and 3 were used. Each test was scored according to the number of correct answers, i.e. 9 in test 2 (tables 4), 13 in test 4 (table 6). The t tests were performed on each test separately comparing viewing of the story animation code and the documentary code. The variable examined was the change in causal explanations. Two tools were used to show screening effect on causal answers: (A) mean score of correct answers, (I) product score for knowledge gain variable correct answers together with justification variable.

Ho^{4} dealing with students' attitudes was tested by questionnaires 4 (to documentary) and 5 (story animation), on a 1-5 Likert scale. A mean score was computed for each test. A t test was performed on independent samples to compare attitude scores between viewing story animation and documentary broadcasts.

Ho^{6} dealing with teachers' attitudes was tested by Questionnaire 6, Part B of which examines attitudes on a 1-5 Likert scale. Data analyses yealding frequencies and percentages were computed for each item.

8. FIRST RESULTS

The first results with respect to study hypotheses are as follows:

Ho^{4}: It may be seen in table 3 that the average knowledge gain following viewing the story animated code was significantly higher ($p<0.001$). A significant rise in the knowledge gain ($p<0.05$) was also found after viewing broadcasts in the documentary code. The proportions of the increased knowledge gain are not differential in the different genres.

TABLE 3: Mean scores and standard deviations of pretests posttests and gains in knowledge

		Animated	Documentary	Effect size
	N	170	190	
Pretest	$\bar{X}$	22.64	24.16	0.14
	S.D.	11.25	10.70	
Posttest	$\bar{X}$	25.49	26.13	0.06
	S.D.	10.89	10.75	
Gain	$\bar{X}$	2.01	3.06	0.11
	S.D.	7.44	8.40	

Paired t pretest - posttest Animated = 4.72***
Paired t pretest - posttest Documentary = 3.68***
t between Animation and Documentation = 1.24

Ho^{2}: As seen in tables 4, 5 among viewers of story animated code broadcast "The Cell", mean change in choice of causal answers declined. The difference between pre- and post viewing results was statistically significant ($p<0.001$). This finding validates the hypothesis.

Among viewers of story animated broadcast "From Fertilization to Birth", the mean change in choice of causal answers was higher. This finding contradicts the hypothesis.

TABLE 4: Mean scores and standard deviation of pretests posttests and change in causal explanations about "The Cell"

		Animated	Documentary	Effect size
Subtest A				
	N	126	149	
Pretest	$\bar{X}$	4.65	4.70	0.02
	S.D.	2.37	2.25	
Posttest	$\bar{X}$	4.26	4.58	0.10
	S.D.	2.16	2.20	
Change	$\bar{X}$	-0.38	-0.13	0.11
	S.D.	2.16	2.27	
Subtest I				
	N	115	133	
Pretest	$\bar{X}$	15.29	16.05	0.05
	S.D.	7.33	6.82	
Posttest	$\bar{X}$	13.03	15.88	0.40
	S.D.	7.57	6.99	
Change	$\bar{X}$	-2.26	-0.17	0.26
	S.D.	7.47	8.09	

Animated Paired t pretest - posttest = 2.02*
Paired t pretest - posttest = 3.14*
Documentary: The gained pretest - posttest t value are statistically non significant.
t between Animation and Documentation, Subtest A = 1.94*
t between Animation and Documentation, Subtest B = 2.04*

* $p<0.05$

TABLE 5: Mean scores and standard deviations of pretests posttests and change in causal explanations about "Birth"

		Animated	Documentary	Effect size
Subtest A				
	N	184	140	
Pretest	$\overline{X}$	3.95	4.34	0.16
	S.D.	2.38	2.45	
Posttest	$\overline{X}$	4.94	4.65	0.14
	S.D.	2.41	2.26	
Change	$\overline{X}$	0.97	0.31	0.30
	S.D.	2.38	2.32	
Subtest I				
	N	164	129	
Pretest	$\overline{X}$	13.47	14.79	0.05
	S.D.	8.43	8.38	
Posttest	$\overline{X}$	15.71	14.88	0.12
	S.D	8.63	8.05	
Change	$\overline{X}$	2.63	0.19	0.27
	S.D.	9.00	8.62	

Animated: Subtest A Paired t pre-post = 5.53***
Subtest I paired t pre-post = 3.56***
Documentary: The paired t pre-post values are statistically insignificant
t between Animation & Documentation, Subtest A = 2.48*

* $p<0.05$
*** $p<0.0001$

Ho^{4}: In comparing 15-16 year old's TV viewing attitudes, it was found that the mean score for attitudes towards the story animation code was higher than that towards the documentary code. As seen in table 6, the difference in attitudes is statistically significant ($p<0.001$). This validates the hypothesis.

TABLE 6: Students attitudes to story animation Vs. documentary codes

Code	N	Mean	S.D.	T	Effect size
Documentation	166	3.09	0.78	3.13***	0.30
Animation	217	3.32	0.62		

* $p<0.05$
** $p<0.01$
*** $p<0.001$

Ho^6: Table 7 shows that over 50 percent of biology teachers are not of the opinion that broadcasts in the documentary code are preferable to those in story animation code, even in the case of science broadcasts. This does not support the research hypothesis.

TABLE 7: Biology teachers' attitudes towards story animated and documentary broadcasts on science subjects
(in %) (N=16)

Item content	Agreement level				
	strongly disagree 1	dis-agr. 2	don't know 3	agree 4	strongly agree 5
No. 30: Documentaries on science are preferable to story animation code.	29.6	29.6	20.4	14.8	5.6
No. 37: Viewing "La Vie" increased interest in biological subjects.	1.9	9.3	25.9	35.2	27.8
No. 38: Viewing story - animation form should encourage science program viewing.	8.9	10.7	21.4	39.3	19.6

9. DISCUSSION

The results show a clear knowledge gain and positive attitudes among 15-16 year olds following non-guided viewing of the story animated code. An improvement took place in knowledge gain following viewing of documentaries, but this is no greater than that achieved following viewing of the story animation broadcasts.

Increase of choice of teleological explanations following viewing of the program on "The Cell", but not on "Birth". This result was influenced by three factors:

a. The subject of reproduction is particularly fascinating to students of the age group tested, and the combination of the subject and animation code aroused great interest which in turn influenced the results of the knowledge test.

b. Other studies have shown that the cell is a relatively difficult subject to study (Bartov, 1978) (Dreyfus, Jungwirth, 1980).

c. Among regular high school students difficulties are found in causal thinking, and teleological and anthropomorphic expressions are found (Tamir, Zohar, 1991); also in subjects taught using means other than television.

It may therefore be concluded that 15-16 year olds can translate the story animation code. These results are congruent with McLuhan (1964) "The Medium is the Message", "The medium teaches itself".

15-16 year olds who have been exposed to the story animation code on television are able to translate messages conveyed in this code. This ability is learned from the television medium itself, and once translation is acquired there is no barrier between the medium and the message. Broadcasts in the animation code are absorbed by the intelligent viewer without the code's intervention.

The research hypotheses represent our ideas, the ideas of Israel's science-teaching population in 1989. They were formulated following teachers' and curriculum developers' fears, regarding the possible effects of the series, on the studets' perception of the biological concepts conveyed.

The results of the study show such fears to be unjustified. 63% of the students in the sample declared that they had viewed programs in the series in their free time.

Teachers' attitudes also changed as they realized that the students' interest in biology increased following exposure to the "La Vie" series (Questionnaire 6, items 37, 38).

59.3% of the teachers (see item 30) do not agree that documentaries on biology and the sciences are preferable to story animation broadcasts.

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A Conceptual Framework for Communication Between Behavioral Scientists and Architects

Terry L. Burnworth

INTRODUCTION TO PROBLEM

For centuries architects have been relying on their own personal knowledge to design the built environment. The architect acquired this personal knowledge with use of direct personal experiences (ie. by visiting similar building types). Due to the complex nature of today's society, the architect is no longer able to acquire all the information needed for a program or design utilizing only direct personal experience. Why? First, the architect is greatly influenced by the socio-economic and political realms of today's society and each of these influences the way the architect thinks about topics. An architect's opinion about a particular topic may be different than the general truth, meaning that the level of objectivity of the architect could be reduced. Second, the number of variables to review when attempting to acquire a large amount of information, is overwhelming. This paper is interested in the social or behavioral influence on design -- what is man's interaction with the built environment?

In the past, the architect was able to perform small studies of man's interaction with the environment, usually due to the fact that there was a single client or political system. Unfortunately, present society will no longer allow this to occur because of the complex nature of the occupants. The time that an architect would spend learning a current methodology of research and then performing the research would not allow him time to work on the design.

For example, if the architect was required to conduct research on a Gerontology Institute prior to the programming and/or designing of the project, the project would never be completed. The architect would spend years just compiling research information. Fortunately, the twentieth century has witnessed the creation of several disciplines which study specific aspects of man's interaction with the physical environment, relieving the architect from performing involved behavioral studies. But at the same time; "How does the architect acquire the research knowledge?"

The architect can no longer use his direct personal experience to acquire knowledge for a program or design. A clear separation between the body of knowledge that researchers have accumulated and the acquiring of the knowledge by the architect has surfaced. Due to this separation, a new method of presenting current research information about the built environment must be reviewed; it must understand the concept of direct personal experience.

Merrill (1976) explains that an emphatic model provides a satisfactory method of transferring information to the architect with the use of direct experience. The empathic model is not really a model, but a concept about the nature of presenting information. Merrill's model suggests that an emphatic method of presenting information be outlined so that the architect may gain information from the presentation. This suggests that two variables need to be defined prior to understanding how to use an emphatic model. First, establish the needs of the architect and second, define an impressive/positive mode of presenting information to fulfill the needs. The need has already been established in this paper. To define the mode of presentation, a review of the history of architecture reveals that a similar system of conveying information has been used for the past five hundred years.

Since the Renaissance period, architects have been "concretizing" their designs by means of a graphic (blueprint). The blueprint, as a means of communicating design ideas to a builder, has not been significantly redeveloped. The blueprint of the building can be categorized as an external "representational device" (Tibbets, 1988). This externalization of objects in the architect's design is the "language" that is most familiar to the architect for conveying information. Laseau (1980) and McKim (1980) explain that the thinking process can also be enhanced by using an "external" graphic process.

The "direct" experience, through the use of a visual representational device, indicates that the architect has a "language" that is specific to the architect's professional community of the architect. The researcher also has a "language" that is specific to the discipline of the researcher's community. For example, the researcher's language may be defined as that of text and scientific representational devices (ie,.line graphs). The researcher's "external" representational devices tend to be more abstract in nature.

Min (1988) explains that the differences between the researcher and the architect can be defined as a two-community problem. Each community has goals and objectives that are supported by the community in which each belongs. The goals and objectives are accompanied with biases in personalities and sometimes ideologies. Because of the number of differences between the communities, there exist fundamental "language" differences. The language differences range from the mode of presenting information, as mentioned earlier, to the terminology differences. This paper addresses the question, "How to communicate knowledge successfully across the communities". Figure 1a shows an example of the differences in representational paradigms.

Two-Community Communication Problem

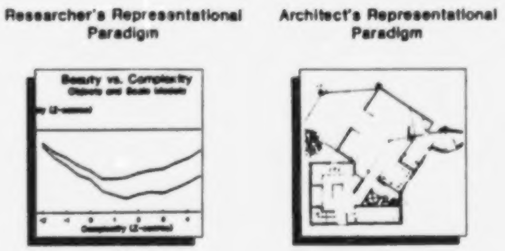
Researcher's Representational Paradigm
Architect's Representational Paradigm
Beauty vs. Complexity

Figure 1a

This paper presents three essential aspects for a conceptual framework to continue research on the communication problem between the scientific researcher and the professional architect. As Churchman (1971) indicates in his work The Design of Inquiring Systems, a conceptual framework becomes a structure from which to outline a research project. This paper provides a logical study of the problem of the research application gap in architecture and provides a method to advance to a solution.

The conceptual framework is divided into three basic components of study. Figure 1b identifies these components.

THREE ASPECTS OF THE CONCEPTUAL FRAMEWORK

I TAXONOMY of INFORMATION

This section provides a classification model for the type of information to be transferred to the architect.

II COMMUNICATION MODEL

This section provides a model for understanding the means and processes involved in transferring information between the researcher and the architect.

III ACQUIRING of INFORMATION

This section outlines a method of researching the communication process by studying the cognitive style differences between the communities. The differences include the acquiring, understanding, and structuring of information for use.

Figure 1b

I. TAXONOMY OF INFORMATION

The taxonomy or classification of information type is as important as the transfer of information. Korobkin (1976) explains:

"It is hard to imagine more eligible candidates for collaboration than architecture and social science. Social science, well versed in people's needs, seems a natural help-mate in architecture's quest to improve the quality of messages that buildings communicate to people".

The study of man's interaction with the built environment has evolved into "Environment/Behavior Research" (EBR). The social science that Korobkin comments about is only one area of EBR. EBR includes such diverse fields as behavioral science and biology, in addition to others that are focused around man and the environment. The formalization of EBR is considered to have occurred around the late 1960's with the development of the Environmental Design Research Association (EDRA). For this paper, EDRA is considered as the organization developed an awareness that research knowledge and the design process should be closely aligned in the planning of the built environment.

Thomas Markus (1969, 1972) has provided a conceptual model for classifying the relationships of people to the built environment in the sequence of a programming/design process. As seen in Figure 2, the model is divided into four parts.

Markus's Model of Building and People Systems

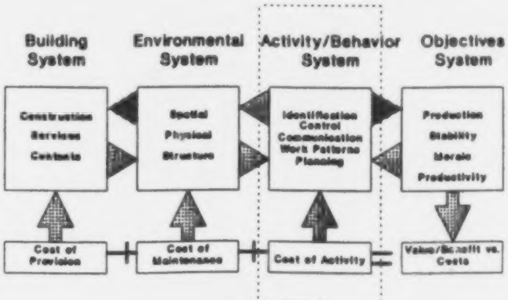
Building System
Environmental System
Activity/Behavior System
Objectives System
Construction
Services
Contents
Spatial
Physical
Structure
Identification
Control
Communication
Work Patterns
Planning
Production
Stability
Morale
Productivity
Cost of Provision
+
Cost of Maintenance
+
Cost of Activity
=
Value/Benefit vs. Costs

Figure 2

The first part, "building system", deals with the economic feasibility of building the structure. This system is sometimes organized by the architect, but others may become involved (ie. persons related to the production of the building from an economic point of view).

The second category, "environmental system", concerns the physical properties of the building's environment. Examples of items in this category include the furniture, the heating and ventilating systems, and the structural systems.

The fourth category, "objectives system", is developed in cooperation with the owner/user of the building. This category defines objectives or goals which the building should fulfill. These goals may be as simple as square footage space requirements or as complex as a requirement to have increased productivity and morale.

The third category, "activity/ behavior system", is the classification category that this paper reviews. The architect has the greatest control within the design process by utilizing the information within this category. The "activity/behavior system" addresses the behavioral aspects of the designed building using man/activity as the dependent variable and the physical environment as the independent variable. This system is directly influenced by the "environmental systems" and the "objectives systems" categories, depending on the amount of information that the architect has from the other categories. Before proceeding to the next section of this paper, a simple, but very important question must be answered: "Is the information needed and wanted by the designer?"

This question has been reviewed in several studies and it has been found that the information is definitely needed, but not necessarily wanted. In a survey study, Merrill (1976) found that architects both need and want to use the EBR during the design process. Seidel and Danford (1979) presented a similar survey at the EDRA 10 Conference and found that the architectural profession would like to utilize the EBR. The differences in personalities, egos, and sometimes ideologies makes communication between the two communities even more difficult. Section III of this paper provides an explanation as to how this difference can be addressed.

II. COMMUNICATION MODEL

To understand the information transfer between the two communities, a communication process model is developed. In 1974, Ostrander presented a hypothesis on why an application gap exists between researchers and architects. Ostrander called the gap problem a "visual-semantic communication gap". He explained that the researcher is oriented toward a written mode of communication, while the architect is visually oriented. Ostrander presented a three-dimensional form (cube), shown in Figure 3, that represents the "type" of communication presentation mode preferred by the architect.

Ostrander's Semantic Cube
1974

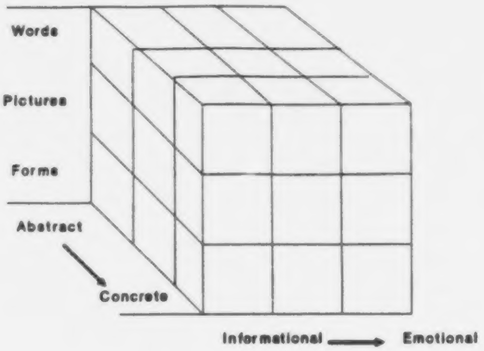

Figure 3

Ostrander suggests that the optimum information presentation to the architect must have the following qualities: the information must be in "pictures", be "concrete" in nature, and be "informational". Once these three qualities are put on the cube, only one sector of the cube may be utilized.

Although Ostrander does not present a model of communication, but rather a preferred presentational mode, he does suggest that the process of communication is equally involved by both communities. Before analyzing Ostrander's hypothesis further, a clear understanding of the process of communication in general must be reviewed.

One of the most simple and generalized models of the process of communication was developed by Berlo (1960). Berlo explains how a model of communication is developed by understanding the process that is used in the act of communication, not necessarily the content.

Figure 4 illustrates Berlo's model of the communication process.

Berlo's Communication Process Model
1960

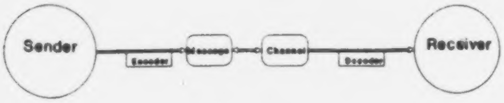
Sender
Encoder
Message
Channel
Decoder
Receiver

Figure 4

Berlo has provided a simplified communication model with only six variables to allow for the universality of the model. Berlo did not present a model which benefits the designer (sender of the message) and the receiver (user of the message) equally. Shannon and Weaver (1949) on the other hand, understood that the message was important, but how to transfer the message was not an issue. Figure 5 illustrates Shannon and Weaver's model.

Shannon and Weaver Model
1949

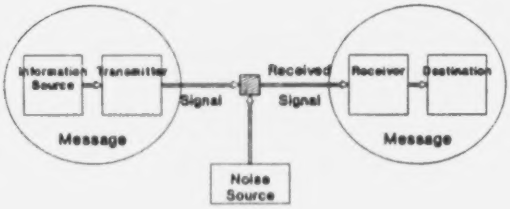
Information Source
Transmitter
Signal
Received Signal
Receiver
Destination
Message
Message
Noise Source

Figure 5

Schramm's (1954) modeling of the communication process for mass communication purposes has given importance to both the message and the two parties involved with the message transfer. Figure 6 illustrates Schramm's communication process model.

Schramm's Communication Process Model
1954

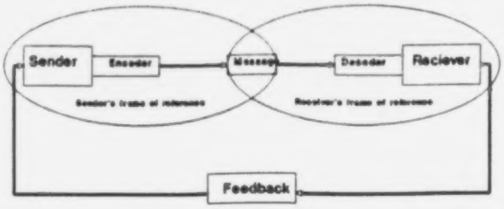
Sender
Encoder
Message
Decoder
Reciever
Sender's frame of reference
Receiver's frame of reference
Feedback

Figure 6

The model identifies the message as the "connection" between the sender and the receiver, the most basic connection between communities. This becomes important toward developing a "holistic" model of communication between researchers and architects. Schramm also understood that the sender and the receiver have varying degrees of understanding of the message, which he identified as "frames of reference". The model includes a feedback loop to provide the sender with a measured response of the success of the information transfer, although the sender will not realize a misunderstood message until the communication is complete. Neisser (1976), Palmer (1978) and Kosslyn (1989) have presented different but similar ideas on how reality can be diversely represented. Figure 7 is an example of three different mental realities of the same object, a ball.

Separate Realities
Three Different Representations of a Thing

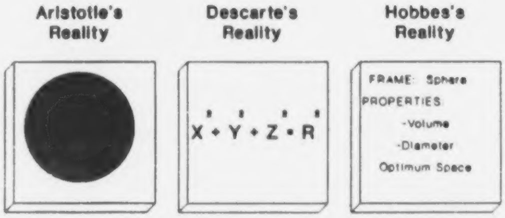
Aristotle's Reality
Descarte's Reality
Hobbes's Reality
X • Y • Z • R
FRAME: Sphere
PROPERTIES:
-Volume
-Diameter
Optimum Space

Figure 7

As indicated above, the difference between mental realities can become extreme. Understanding that the differences exist in represented realities becomes extremely important to the success of information transfer. Schramm's model can be modified with communication interaction to reveal a model that can be adapted to any given situation. For example, instead of trying to introduce the sender's reality to the receiver and the receiver's reality to the sender, it would be more useful to create a new reality that represents both communities.

Kolancy (1969), a cartographer, proposes a model of communication that recognizes that each community has an equal part in the process. Kolancy's model uses a "universe" that is part of the sender's and receiver's understanding of the message. Kolcany's purpose was to create a system that the sender (or map maker in his case) could use in the designing of graphics (in this case, maps). The problem with the model is: "How do you understand the universes?" Figure 8 shows a concept of a two-community communication process model which is made up of a few essential components.

Two-Community Communication
Process Model

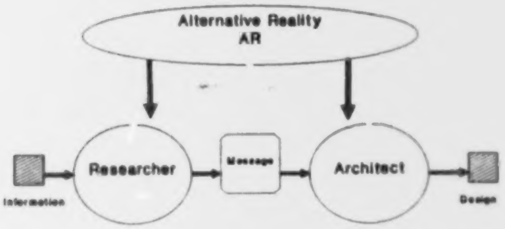

Figure 8

As compared to Kolcany's model, the clear separation of the sender's and the receiver's realities and the concept of an "alternative reality (AR)" are the basic differences. The AR is an area that contains knowledge from both communities, the researcher's and the architect's representational paradigms. To "fill" the AR with useful and meaningful information, the representational (intellectual) structures of each community must be studied. Section III of the framework provides a brief outline on how to study the intellectual structures of each community.

III. ACQUIRING OF INFORMATION

There are several routes to studying the way information is acquired by people. For example, study could focus around the physiology of the subjects involved in the communication process, ranging from a study of the physical properties of the eye to a study of brian activity with use of EEG printouts. Another way of studying information acquisition may be from a behaviorist's point of view, which may include the relationship of personality to the acquiring of information.

The framework within this paper deals with the psychological differences (cognitive differences between the communities) and the effects that such differences play in the role of transferring information. Before proceeding with an explanation of how the cognitive differences will be measured, a model of how cognitive theory relates to the real world needs to be understood.

Palmer (1978) outlines how cognitive theory helps understand how and why mental images of the real world are constructed, helping to explain how the world can be understood by means of cognitive theory. Figure 9 illustrates Palmer's cognitive representational system in relationship to the "real world".

Palmer's Cognitive Representational Model
1978

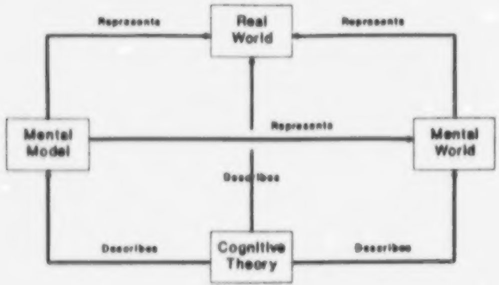
Represents
Real World
Represents
Mental Model
Represents
Mental World
Describes
Describes
Cognitive Theory
Describes

Figure 9

Palmer's explanation of cognitive representation is rather philosophical in nature. To understand the cognitive differences between the two communities in a more practical manner, a review of the cognitive style literature will be required.

Witkin (1962) has provided a clear explanation of psychological differentiation. Witkin explains that there are clear differences in acquiring, structuring, and formulating information cognitively. These different "intellectual controls", as Guilford (1980) defines the styles, have been studied for the past 30 years. Research results have shown that a difference in the intellectual structure of a subject is correlated to the personality of the subject. For example, Ostrander's cube may not be entirely valid when stating that the architect needs pictures in a presentation. The answer is not that simple. The problem cannot be solved by surveying methods of presenting information without a fundamental basis for the survey. By understanding that there are differences in the way each community acquires and structures information cognitively, a basis for constructing the information may be outlined.

Witkin's (1981) psychological differentiation is tested with use of the Group Embedded Figures Test (GEFT), which measures the field dependence (FD) and field independence (FI) of a subject. Witkin has shown that the FD and FI are reliable measures of cognitive structures, indicating that there exist clear differences in the way information is perceived, acquired and structured.

Guildford (1986) has developed a theory on the psychological differences and their implications on subjects. Figure 10 illustrates Guilford's "Structure-of-Intellect" model.

Guilford's "Structure-of-Intellect" Model
1986

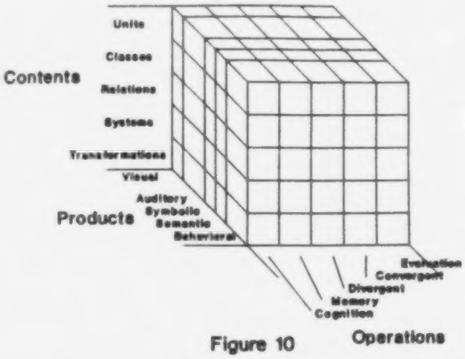
Units
Classes
Contents
Relations
Systems
Transformations
Visual
Auditory
Products
Symbolic
Semantic
Behavioral
Evaluation
Convergent
Divergent
Memory
Cognition
Operations

Figure 10

The model above, which is actually a theory about the intellectual ability and controls of a subject, exhibits the diverse psychological and behavioral implications influenced by cognitive structures.

DISCUSSION

The preceding sections of this paper presented three aspects of a conceptual framework to continue research on the subject of communication between research scientists and environmental designers (architects). The framework has been designed with the understanding that a visual system of communication is to be used. The aspects of the framework are presented in an order that represents the systematic process of completing the research.

The process becomes systematic due to the questions that appear at each of the three levels of the framework. For example, if the taxonomy of information indicates that the research information is not valid or required by the architect, no further research on transferring the information would be needed. The same idea is true for the second level. At the communication model level, if the process of communication would reveal an outline on "how to" construct messages for optimum information transfer, no further research into the information acquisition level would be needed.

The framework model consists of three levels. First, the taxonomy of information is defined, then the process of transferring the information is defined, and then the structures from which to make the information understandable across the communication process are compiled. The first phase of research from this framework will establish reasons as to why information transfer has not been completely successful in the past. The second phase of research should contian a study to evaluate the results of the first phase.

The primary purpose of the framework is to present a structured outline for continued research on the subject of information transfer between diverse communities. Having an understanding of the message, the process of transferring the message, and the way that each community acquires and structures information compared to the other, will contribute to a successful informational knowledge transfer.

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Describing Picture Content

Rune Pettersson

In communications, the sender is anxious for different receivers to perceive her/his message in the same or at least in similar ways. But this is seldom the case. Major discrepancy between the sender's perception and the individual receiver's perception is very common (Pettersson, 1989, 78-92). A picture always represents a *choice* among several alternatives. A picture represents a "frozen" slice of time. Something is always going on *around*, *before* and *after* a depicted event.

In one experiment (Pettersson, 1989, 85) adult subjects were asked to draw pictures depicting events in the enclosed field around six small and simple illustrations. They were also asked to draw pictures depicting the events they considered to take place "before" two and "after" two pictures. Subjects also wrote explanatory captions. The subjects draw a total of 378 pictures and wrote the same number of captions. As expected, subjects had very definite and differing opinions about what was probably going on around particular pictures and about events prior to or after a depicted situation.

This experiment has been repeated with four of the original pictures ("cat", "dog", "boat"", and "cloud"). The first two of these pictures refer to the question of *around*. The other two refer to the questions of *before* and *after* respectively. The results of this experiment confirmed the results from the first study.

Around

For the first assignment, 120 subjects drew an average of 49 different depictions of the picture's contextual events (table 1). On the average, 24 different motifs were drawn by more than one subject. The most common motif was selected by an average of 16 persons.

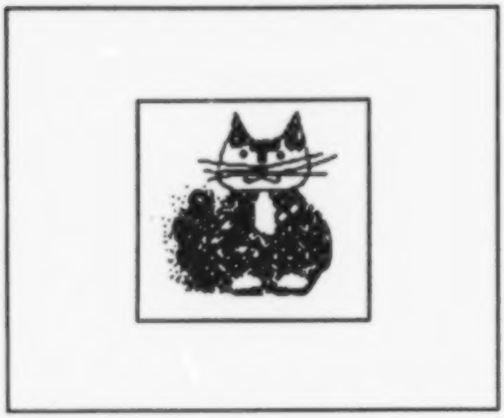
Table 1. Number of motifs created around test pictures.

	Stimulus		
	cat	dog	m
Number of different motifs	45	53	49
Number of motifs depicted by more than one subject	27	21	24
Number of drawings of the most common motif	14	18	16

n = 120, 240 pictures

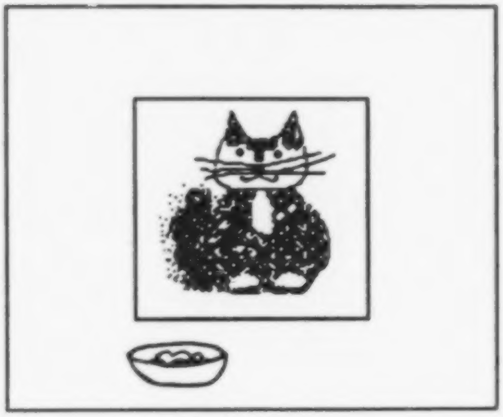
Most subjects (71%) ignored the inner frame when depicting context. However, the inner frame was utilized as significant image element in the composition of 69 pictures. The inner frame was then incorporated as e.g. a window, painting, poster, book page, aquarium or cinema screen, to mention just a few (see presentation of actual results). Context therefore governed the size of the original motif.

Assignment 1: Supplement the picture by filling in the in formation you feel should be between the inner and outer frames. Write an explanatory caption. (This picture is reduced in size to 83%.)

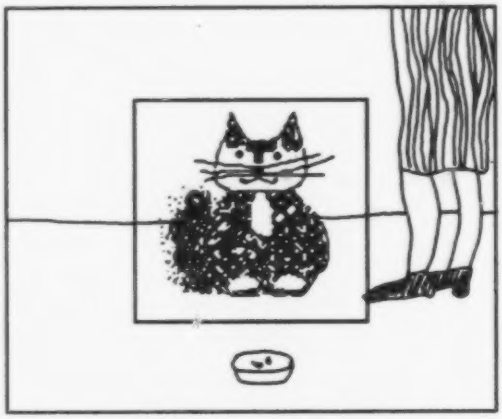


The drawings had the following motifs:
a bowl with food (14), a bowl with food and furniture in a kitchen (9), a bowl with food and mistress (5), an empty bowl, the cat has had enough to eat (3), a bowl with milk poured from a pitcher (2), the cat is on the floor (6), the cat is on the floor in front of a wall with striped wall-paper (3), the cat is on a table (3), the cat is in a book-shelf (3), the cat is out in the sunshine (3), the cat is looking out through the window (2), the cat is looking into an aquarium (2), the cat is on a staircase (2), the cat is in front of a screen and will have its photo taken (1), the cat is on the floor in front of a log-fire, the children are eating apples (1), the cat is on a wooden fence (1), the cat is outside a fence (1), the cat is on a roof (1), the cat is on a beach looking at the sea (1), the cat is in a pet-container (1), the cat is waiting outside a mouse-hole (1), ball of yarn (8), the cat is in a basket playing with a ball of yarn (3), the cat is on the lap of a girl playing with ball of yarn (1), the cat is in a box (1), the cat's mother (2), two other cats (2), three kittens (2), another cat and a bubble of thought with a heart (1), the cat is in a street together with two other cats (1), legs of children (2), mouse/mice (6), one mouse and skeletons from two fish (2), different "things that a cat may need" (1), a picture on a wall (9), a picture on a wall and a cat on the floor playing with a ball of yarn (1), a TV-image (2), a picture an a knitted sweater (4), a picture on a pillow (2), a picture an a tapestry (2), a picture on a bib (1), an image in a view-finder of a camera (1), an image on a Macintosh-screen (1), text (2) and lines only (1).

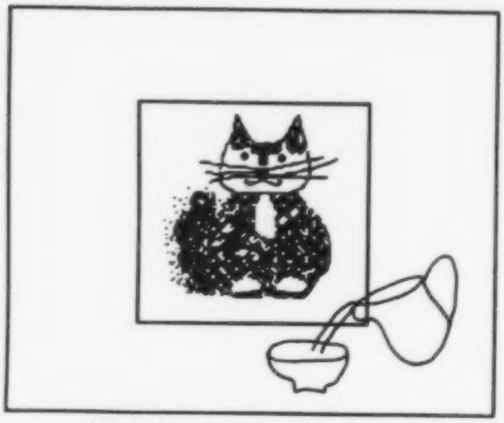
Some examples of "around" the framed image.



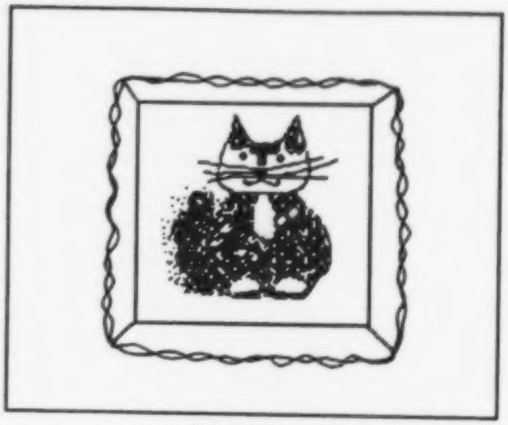
a bowl with food



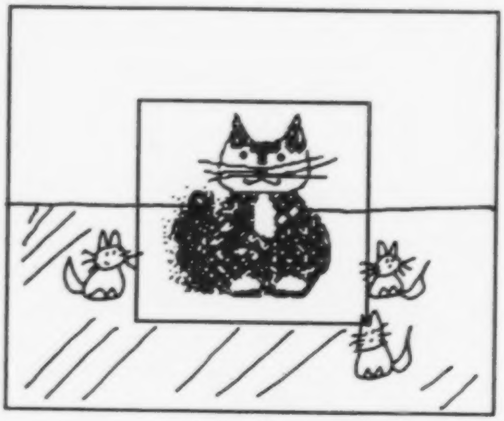
a bowl with food and mistress



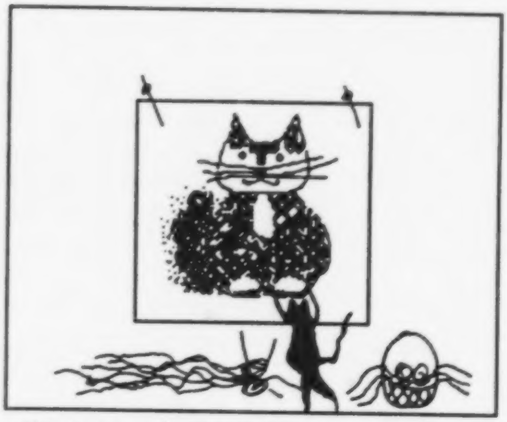
a bowl with milk poured from a pitcher



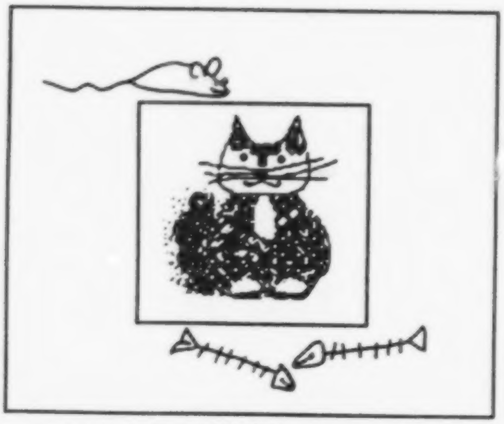
a picture on a wall



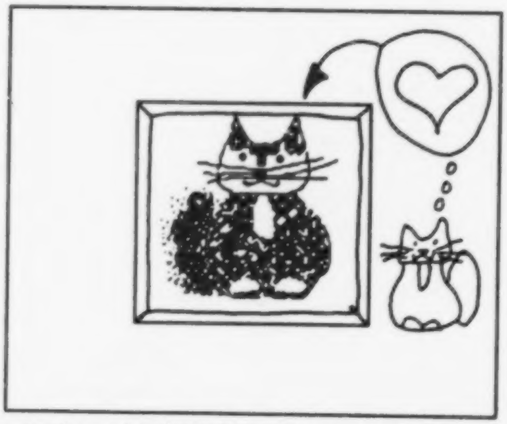
three kittens



a picture on a wall and a cat on the floor playing with a ball of yarn

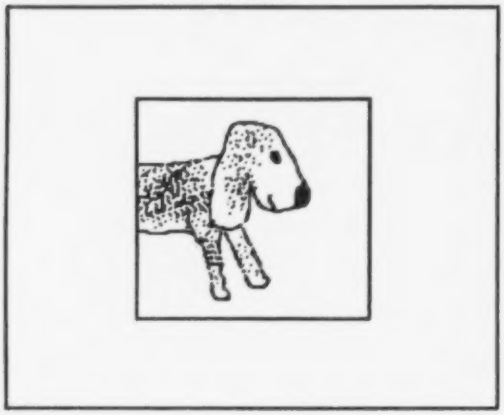


one mouse and skeletons from two fish



another cat and a bubble of thought with a heart

Assignment 2: Supplement the picture by filling in the in formation you feel should be between the inner and outer frames. Write an explanatory caption.(Here the picture is reduced in size to 83%.)

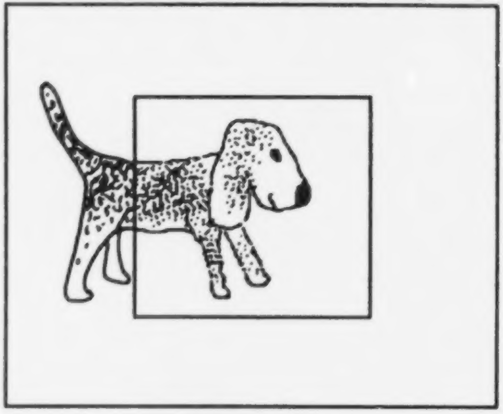


The drawings had the following motifs:

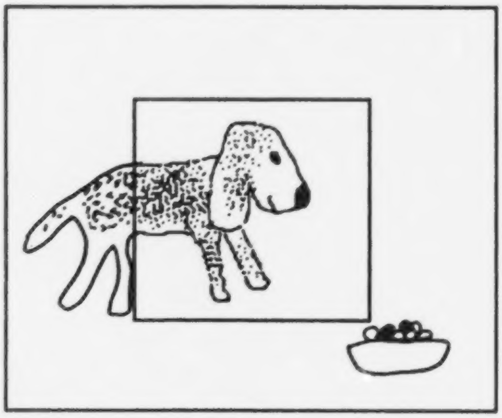
a, the picture is supplemented with a "behind" to a complete dog: only a behind (18), a bowl (9), a bowl and a person (3), part of another dog and legs of a person (6), the master is coming home, wag of the tail (2), the mistress is coming home, wag of the tail (1), another dog (5), another dog and bones (3), another dog, heart and bones (2), cat (1), legs of a person (4), the dog takes a walk (4), the dog plays with a ball (3), the dog takes a walk on the sidewalk (2), a lamp-post and a cat (2), the dog kicks (1), the dog wets the carpet (1), the dog is on the lap of a child (1), the dog is partly hidden behind a tree (1), the dog is standing outside a kennel (1), the dog is preparing for a hare-hunt (1), the dog has been run over by a train (1), the dog is in the woods (1), a picture in a newspaper (1),

b, the picture *is not* supplemented with a "behind" to a complete dog: inside a kennel (6), inside a kennel, an angry dog is waiting outside (3), mirror, half a dog to the left (2), another dog (3), children and another dog (1), inside a "pet-door" in a large door (1), cat (1), the dog goes behind a house (1), coming in to have supper (1), coming out of the kennel (1), looking out of a "pet-door" (1), looking out through a window (1), two trees (1), outside of a "pet-door" (1), taking a walk with children (1), taking a walk with the master (1), a puppy looking from behind a broken frame (1), hand-puppet, a dog in a puppet theatre (2), image of dog in TV-set (2), part of a warning sign (1), picture on a wall, a child carrying a dog (1), photo of a dog (1), dog with a human behind, a person at a masquerade (1), toy dog an a shelf (1), radio operated toy dog (1), picture on a wall (1), sweater, knit a portrait of your dog (1), text (3) and square pattern (1).

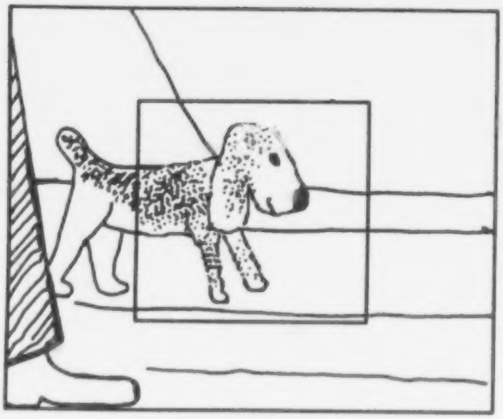
Some examples of "around" the framed image.



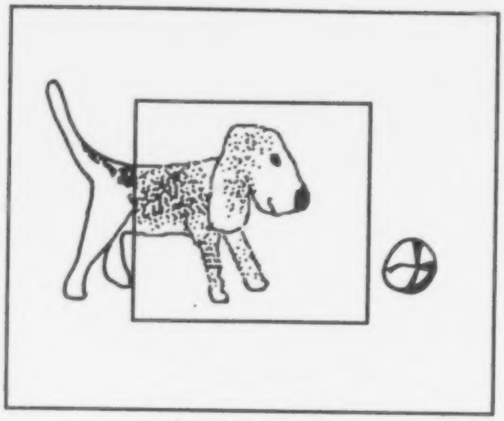
only a behind



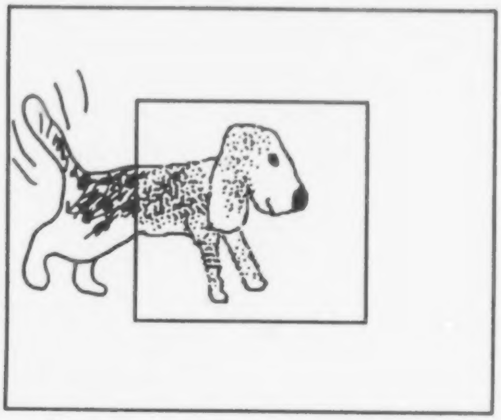
a bowl



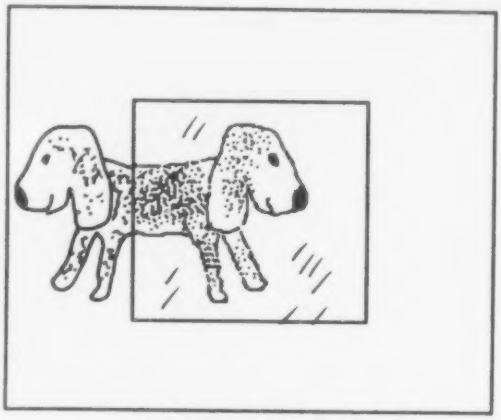
legs of a person



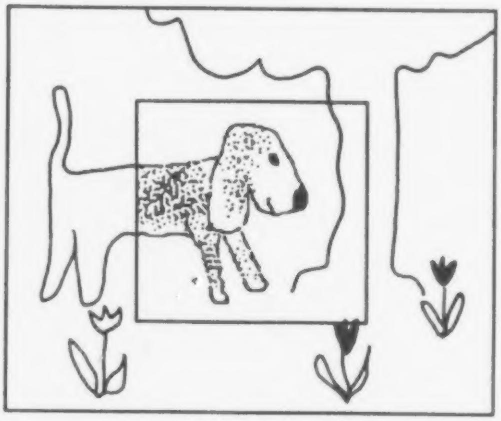
the dog plays with a ball



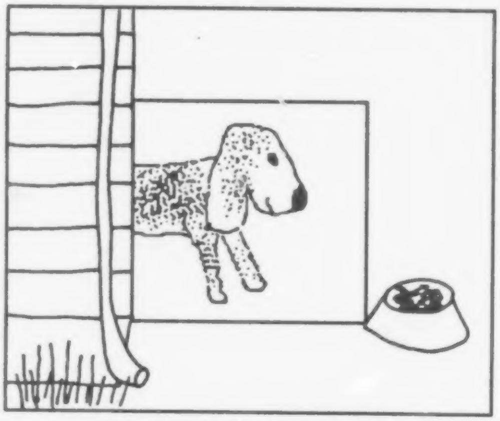
the master is coming home, wag of the tail



mirror, half a dog to the left



the dog is in the woods



the dog goes behind a house

Before -after

As regards the second assignment, 120 subjects produced an average of 29 depictions of events preceding and following each picture (table 2). On the average, 18 different motifs were drawn by more than one subject. The most common motif was selected by 18 persons.

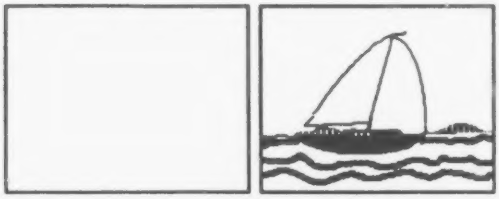
Table 2. Number of motifs created before and after test pictures.

	Stimulus boat	cloud	m
Number of different motifs	29	28	29
Number of motifs depicted by more than one subject	21	14	18
Number of drawings of the most common motif	16	19	18

n = 120, 240 pictures

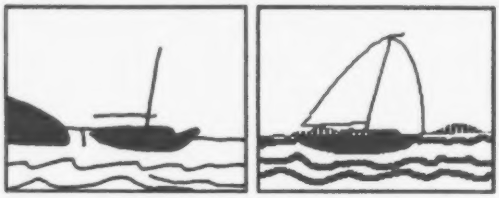
The results showed far closer agreement between the subjects' perception of events "before - after" than of events "around". The latter produced fewer motifs (29 vs. 49). In addition, the most common motif was represented in more pictures (24 vs. 18). However, the number of motifs drawn by more than one subject was about the same for both assignments (16 vs. 18).

Assignment 3: Supplement the picture pair below. Draw what happened "before" the events depicted in the picture to the right. Write an explanatory caption. (Here the picture is reduced in size to 63%.)

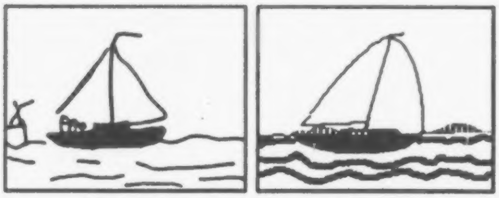


The drawings had the following motifs: the boat is at a bridge (16), the boat is at a bridge with people (12), the boat leaves a bridge (9), the boat is tied to a a buoy (6), the boat lies at anchor (4), another four boats (3), another three boats (3), another two boats (2), race for sailing-boats (1), a large fishing-boat is passing (1), slack sails (11), the sails are hoisted (8), one sail is hoisted (6), no sails are hoisted (5), wind in the sails, sunshine (4), towing another boat (2), the front of the boat (7), the rear part of the boat (3), close up of the mate (2), passing an island (2), a man is kicked out of the boat (1), water only (3), water and islets (2), icy water (1), navigation mark (1), a person in another boat is looking in a pair of binoculars (1), a large crane is lifting the boat into the water (1), a hand puts a toy boat in water (2) and, a toy boat (1).

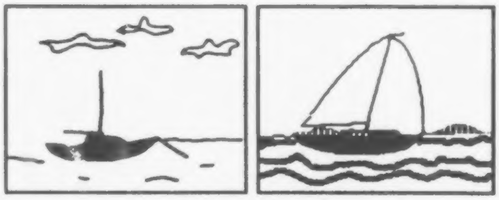
Some examples of "before" an image.



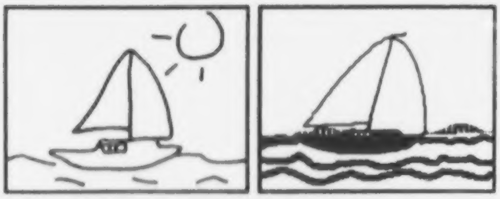
the boat is at the bridge



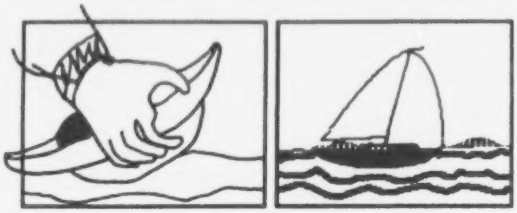
the boat is at the bridge with people



the boat liesat anchor

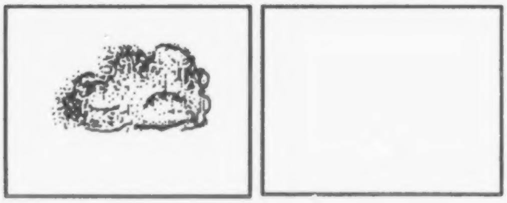


the sails are hoisted



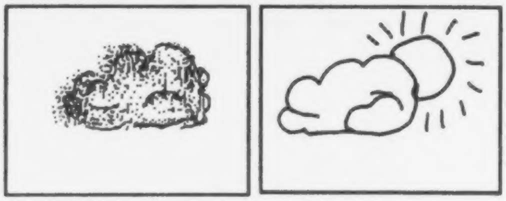
a hand puts a toy boat in water

Assignment:4 Supplement the picture pair below. Draw what happened "after" the events depicted in the picture to the left. Write an explanatory caption. (Here the picture is reduced in size to 63%.)

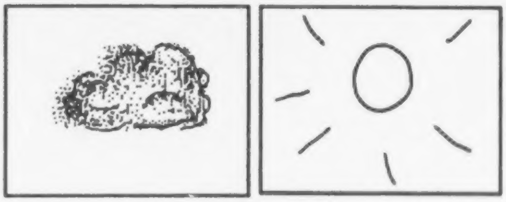


The drawings had the following motifs: the sun is seen to the right of the cloud (19), the sun is seen above of the cloud (9), the sun is seen below the cloud (7), the sun is seen to the left of the cloud (6), the sun and sunshine (4), rain and a flash of lightning (18), rain (16), rain and snow (9), empty frame - nice weather (4), a larger cloud (4), a bird comes out of the cloud (1), Erós comes out of the cloud (1), an exploding cloud of gas (1), a cloud of smoke from an old train (1), a clothes line with clothes (1), rain on an umbrella (1), a pile of dust (2), a vacuum cleaner sucking dust (1), a sponge in a bucket (1), a frog (1), a toad (1), a sleeping dog (2), a dirty dog (1), a hen (2), a chicken (1), a fried hen on a plate, knife and fork (1), an exploding amoeba from outer space (1), and, nothing (4).

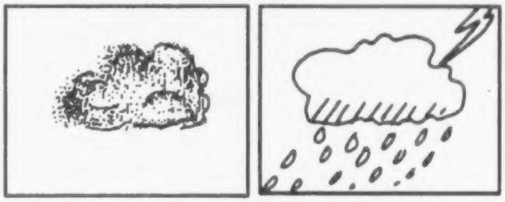
Some examples of "after" an image.



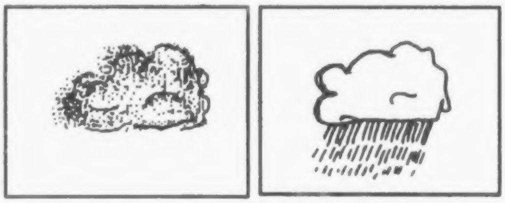
the sun is seen to the right of the cloud



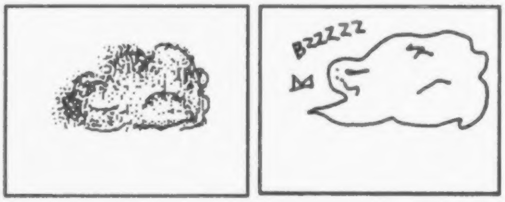
the sun and sunshine



rain and a flash of lighting



rain



a frog

Discussion

The results show that the subjects have treated the visual information in a conscious and analytical manner. The results suggest that each subject placed available information in a wider, expanded, "personal" context. All the interpretations were realistic and about equally credible. We are apparently capable of sensing far more information than is explicitly displayed in a given picture. Adult perception tends to be holistic rather than detail-oriented. No one, except the original picture creator, can state with absolute certainty what is *really* going on around a particular picture's events or what *really* happened before or after the situation depicted in a selected picture. All the subjects still expressed opinions about circumfluous events on their drawings. They also tended to feel that their particular interpretations were the correct ones.

So consensus about the way a picture's explicit and implicit contents should be perceived is extremely limited. Opinions about implicit context are even more wide-ranging. Every picture can be said to possess an "individual interpretation dimension" which depends on available stimuli (the signs used to form the picture, the faithfulness of depiction, etc.) and the individual viewer's cognitive capacity. Since people are different, pictures will always be interpreted in different ways.

References

Pettersson, R. (1989). *Visuals for Information. Research and practice.* Educational Technology Publications: Englewood Cliffs. New Jersey. USA.

Creativity and the Instructional Designer: How to Nurture One's Own Creativity

Richard A. Couch
Helen B. Miller

Introduction

Creativity and the systematic approach to instructional design may seem incompatible at first glance. Any systematic approach implies rigidity and conformity. Creativity seems so "fluffy," so hard to get a handle on. In many settings, particularly business training settings, creativity often is discouraged as a waste of time and money. However, some businesses are evaluating this notion of creativity, particularly in the area of product innovation.

As businesses seek new sales strategies, more desirable employee relations, and more innovative products, management has discovered the need for more innovative training. Unfortunately, most of the instructional materials and methods being produced in industry are repetitive and boring; they often look exactly alike from company to company. This lack of innovation creates ineffective instruction and destroys motivation in both the learner and the designer.

Interestingly enough, for years business people have respected intuition. Successful business people have demonstrated a keen sense of this "knowledge which exists without some sort of conscious reasoning" (Ray and Myers, 1991, p.8). But this intuition was never labeled as creativity; it was more like an instinct, very hard to label and impossible to teach to others. In an effort to avoid this undefinable quality and try to keep product development simple and cost-effective, many businesses overemphasize analysis. This is no less true in the field of training. As many good athletes know, "To analyze is to paralyze." Once the problem has been identified (this is often the step in problem solving most commonly left out) we tend to analyze it until it goes away or is miraculously solved. This lack of creativity and overanalysis allows designers to force instruction into the design model rather than use the design model as a heuristic. In many companies, this analysis tends to be the most important step toward a solution. The team leader defines the problem and soon the rest of the team will generate 20 solutions. A solution will be chosen and the product developed; later it is discovered that we really didn't solve "the" problem because we didn't identify the real problem in the first place. Unlike this analysis approach which is only interested in the solution or the product, a creative approach to problem solving is an ongoing process, not a destination.

The systematic design model as developed by Gagne and Briggs (1979) is like a road map. When you take a trip, you can go the most direct route and get there in the shortest time. This produces a boring trip and often a very tired traveler, especially after several hundred trips down the same road. On the other hand, the traveler could decide to leave at a different time, use a different vehicle, take an alternate route, take more time to arrive, etc. The destination is the same but the process is different; in instructional development terms, the student is trained, but his or her feeling about the training is more positive. He or she is willing to be trained again. (Many businesses find a large portion of their profit is spent on training. Part of our job as trainers is to encourage long term learning and the desire to learn. It is much more cost effective to train them once and to have trainees who willingly participate in inservice types of activities.) The traveler arrives more refreshed and excited about the trip. Being creative is a heuristic approach to instructional design. Creative behavior should be an integral part of the design process because this behavior is useful, resourceful, correct, and valuable to the process. Creativity is not simply being different for the sake of difference. The end product (the instructional materials or method) is important; however, designers must start to explore their own creativity in order to develop more innovative instruction. This entails a lifetime of exploration, not a series of isolated or random "good ideas."

It's easier to be creative in a company whose policies and management encourage creativity, but it is not a requirement for individual creative expression. Through the years, researchers have explored two different ways to infuse creativity into business settings: 1) change the environment or 2) change the individual. Amabile (1983), Csikszentmihalyi (1975), and Simonton (1975) have advocated the social psychology of creativity in which the work environment is altered to allow for more innovation and creativity. (The authors have explored this idea in other articles. See Couch and Miller, 1990.) This makes sense. It is easier to change the work place than to change individual personalities. However, this does not mean that individuals cannot change, cannot become more creative. There are many strategies which can be used to enhance one's own creativity. This article will address ways to enhance individual creativity and how this enhanced individual can help develop a more creative instructional design package. This article will include 1) the nature of creativity, in other words, how is creativity determined; 2) the roadblocks to individual creativity and how we can overcome those roadblocks; and 3) how individuals in a group design process can be more creative.

Creativity has been explored for a long time. Some of the methods of developing creative products have been developed through the years and are recognized as being effective, e.g. brainstorming, synectics, analogical thinking. But individual creativity is much more than simply being able to use a problem solving strategy. It is, first, the recognition of a need to be creative, and second, the total immersion of the self; the expressing of an inner vision or even a passion for life. This is a vision which comes out of an individual's innate curiosity, sense of adventure, and willingness to experiment and take risks. Everyone has these traits in varying degrees. Different personalities demonstrate these traits more than others, but everyone has an essence of creativity within. Many factors destroy or subvert creative thinking--public schools are one of the most insidious destroyers (many of the roadblocks to creativity are present in schools). But no matter where you start on the road to creativity, if you want to become more creative, there are some steps which can lead to a more creative self. The first step is to learn more about creativity and how it is determined. But, learning about something does not mean that your personality will change. You have to commit to change. The second step is to recognize the roadblocks to creativity. And finally, you must start applying simple techniques to your own life and your instructional design methods.

The Nature of Creativity

What needs will business have in the near future and beyond? Many futurists think that the skills we are teaching in the public schools are not those which will be needed in the future. As fast as knowledge is changing and increasing, how can we teach all the facts necessary to survive in the world? The Education Commission of the States, 1982 indicates that the "basics of tomorrow" are the following:

- Evaluation and analysis skills
- Critical thinking
- Problem-solving strategies (including mathematical problem-solving)
- Organization and reference skills
- Synthesis
- Application
- Creativity
- Decision-making given incomplete information
- Communication skills through a variety of modes (Costa, 1985).

Do you have these "basic" skills? The need for more designers who have these "basic skills" seems evident. However, where will these designers get the training to be able to perform these skills? It is unlikely they will get them in traditional graduate schools; it is more likely they will have to train themselves in these skills. Creativity is only one of the skills necessary to meet the needs of future designers of instruction.

But what is creativity? Is creativity in art the same as creativity in business? Creativity is one of the most elusive terms in psychology. The difference between the artist and the business person or the instructional designer is not in the nature of creativity itself but rather the medium in which one works. One is able to be creative if one is open to the possibility of the need for creativity. It is hard to be creative if one does not perceive the need for it. One thing creativity research has been able to determine is that intelligence and creativity are not correlated. The term genius is often used to describe both the highly creative person and the highly intelligent person. However, it is important to note that they are not the same.

A response will be judged creative, according to Amabile (1983), to the extent that (a) it is both a novel and appropriate, useful, correct, or valuable response to the task at hand and (b) the task is heuristic rather than algorithmic. Even routine activities can be creative. (Think about the way you transport yourself to work every day. Is there a creative way you could do it which would break the routine?)

The Elements of Creativity

The first element which exists in creative people is their ability to be persistent, the ability to go on in spite of overwhelming obstacles. This persistence requires a passion for the product and a focus. Passion is a word many creative people use to describe their work. But passion or vision doesn't have to be in the arena of work; a passion for living can mean taking a different way to work or avoid getting caught in a daily routine which becomes a confining ritual.

The next four categories of creative performance come out Guilford's (1963) work. All of these elements must be present in order to classify someone as creative. Often, a person may have one of these traits, but that does not mean the person is creative. Creativity is a very complex process and many people have tried to quantify this elusive term. However, many researchers continue to use these elements as a starting point in trying to explain creative process (See Torrence, 1980).

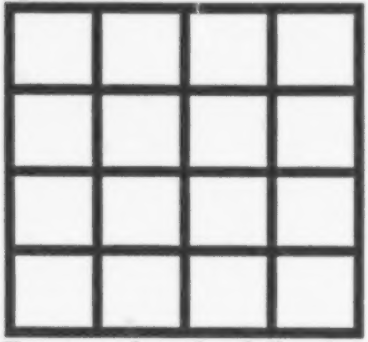
Fluency

Fluency refers to the quantity of one's thinking. This means the ease with which you use stored information when you need it. For example, in thirty seconds write down as many words as you can think of which are similar in meaning to the word "light." (See some possible answers at the end of the article.)

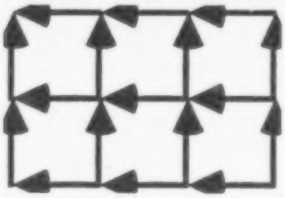
Flexibility

The second creative element is known as flexibility. Another way of looking at this is freedom from rigidity. Several examples of flexibility skills follow:

How many squares exist in this diagram?



Try to solve the following problem to demonstrate flexibility. Remove four arrows and leave three squares.



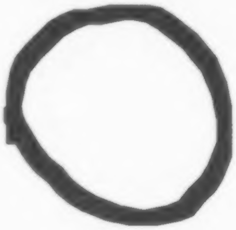
(See answers at the end of the article.)

Originality

Originality is a creative element which is hard to measure. Originality is novelty or uniqueness of responses. What makes something original? Guilford and later Torrence addressed this need for quantifying what makes something original. These researchers also addressed the fourth element, elaboration, in the same way. They established a norm for what an "ordinary" response would be like and a "creative" response would be much different than the ordinary response for a problem. This is a statistical infrequency of responses. For example, ask individuals to list as many consequences as they can in a given time if a particular event took place: What would happen if the volume of the ocean decreased by 10 per cent? There are a large number of normal responses one could expect from this problem. By comparing "new" responses to the norms established by asking hundreds of others to respond to the same question, the researchers could determine the creativity of these new responses.

Elaboration

Elaboration is the last of the elements of creative thinking. It is the development of ideas, addition of detail, interconnections with other similar and dissimilar ideas. The creative individual may be able to produce large numbers of additions in order to elaborate basic material which he himself has been given. For example, elaborate on the following "circle."



Highly creative individuals will produce unusual and detailed drawings incorporating the simple shape given above. Again, the norm might be to produce a human with the circle as the head, but the creative person will elaborate in great detail and produce something unique. (The Open University, 1972)

These four elements along with persistence must be present in order to consider someone creative. Individuals can develop these elements in themselves. The first step in developing these elements is to decide that there is a need to be creative. The second step is to simply start working on improving your creative thinking by working on one element at a time. The same is true for learning any new skill--you must learn one skill at a time before you move on to others. Trying to change everything at once is impossible. Finally, you must avoid the "roadblocks to creativity."

Roadblocks to Creativity

Evaluation and reward

A great deal of research has been done in regard to evaluation and its effect on creativity. Most of the research indicates that creative people create for the sake of the intrinsic reward, not for external praise or for financial reward. This notion goes back to the passion of the creative person. If you want to be creative, find projects which appeal to your intrinsic motivation and avoid external reward. Additionally, constant evaluation, especially if the evaluator is not trusted, stifles creativity. Evaluation is often unavoidable in most business settings; however, to avoid the stifling element of evaluation, try to get management to evaluate after the project is over rather than during the formative phase of the project. Or simply build a trust relationship with management which allows you to develop creative products without their external evaluation. Ultimately the client is the final judge of the product and thus you can't avoid evaluation totally. Also, avoid falling into the trap that a lot managers try to use to motivate people, namely financial reward (business people have a strong sense of financial reward being the most important reward). Most creative people say they do their job so well because they are internally motivated. Many very creative people lose their intrinsic motivation after receiving external rewards.

Competition

Most creative people are instrinsically motivated and therefore, are not motivated by competition. In order to be creative try to avoid being put into a situation where you are required to compete for your ideas to be heard. A design team is created because no one person is capable of knowing everything necessary to produce a quality learning product. Cooperation is essential to produce a unique product.

The by-word in business today seems to be "competition." You hear about competition from car manufacturers to pyramid sales people. "We need to be more competitive in the world market." This may be true in the sales force, although there are very creative salespeople, but in the design process, creativity is destroyed in a competitive environment.

Restricting Choice

Albert Einstein felt strongly that creativity could not be promoted by force. This was true because of his schooling which was militaristic and stressed memorization and severe discipline. A structured environment destroys creativity. Many creative people do their best thinking at strange hours, hours which might not conform with those of their business colleagues.

Rigidity in the work place destroys creative process. Often managers hire designers who think like the manager. This makes the manager's job easier; they know what the other person is thinking. To an extreme, some managers hire only those graduates of certain universities. The new employees were all trained by the same people and often have the same values and attitudes. Two questions you should ask when being interviewed for a job, "Is the work force diverse and are the hours flexible?" This flexibility is not just one sided. A creative person is willing to work intensively for 10, 12, or 14 hours a day to create a worthwhile project. This type of intense work will not happen in a setting that structures work hours or in a setting where fellow workers are worried about "looking bad" or being compensated for long hours. Try to find a job which allows you to be flexible rather than a job where management and employees are hung up on arbitrary rules.

Conformity

Since most of us are products of a public school system which discourages uniqueness and encourages conformity either through peer pressure or through teacher expectations, it is very difficult to know how to look for alternative solutions to problems, especially if the solution is proposed by the boss. The designer must look for alternative solutions which do not conform to the standard or "easy" solution; constantly be aware of the pressure to conform. If you feel that pressure, you must recognize it for what it is and immediately oppose it (Amabile, 1989).

Fear

The most insidious of all the roadblocks to creativity is fear. It is very difficult to recognize. Fear manifests itself in many ways. A person who is not creative may have many of the following fears:

- fear of being criticized
- fear of losing security of habit
- fear of disturbing traditions
- fear of losing love of the group
- fear of truly being an individual
- fear of being associated with taboos
- fear of being misused
- fear of being a fool
- fear of making a mistake
- fear of being "successful"
- fear of being alone

Fear is simply the reluctance to deal with the unexpected. It might be the anxiety related to the unknown. Or it might be the result of a lack of

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preparation to deal with what is expected. But fear deters progress toward creativity by misdirecting our energy. We need to change our focus from "I don't want to be wrong." A more clear and creative focus might be "I will try to be creative and not worry about what is right." This positive point of view can help you to overcome this roadblock to creativity (Koberg and Bagnall, 1981).

Developing Individual Creativity

Creative thinkers can be differentiated from those people who are not creative in several ways.

- The creative thinker welcomes problematic situations and is tolerant of ambiguity while the non-creative thinker searches for certainty and is intolerant of ambiguity.
- The creative thinker is sufficiently self-critical; looks for alternate solutions and seeks evidence on both sides of an issue. The non-creative person is not self-critical and is satisfied with first attempts.
- The creative person deliberates, reflects and searches extensively. The non-creative person is impulsive, gives up prematurely, and is overconfident of the correctness of his initial ideas.
- Creative people are open to multiple possibilities, consider alternatives and are deliberative in analyzing possibilities. The non-creative person prefers to deal with limited possibilities and does not seek alternatives to an initial possibility.
- Finally, creative thinkers use evidence that challenge favorite possibilities and consciously search for evidence against possibilities that are at first strong. She searches for evidence in favor of those possibilities that are initially weak. The non-creative thinker ignores evidence that challenges favored possibilities and searches for evidence that will support his favored possibility (Costa, 1985).

An instructional design product is considered creative when it is novel (unique), when it is appropriate for the problem to be solved, when it has been transformed and used in another way other than originally intended, and when it is condensed from one shape to another (The Open University, 1972). When Amabile talks about heuristic in her definition of creativity, she means it in much the same way that Gagne and Briggs (1979) discuss the systematic approach to instructional design. The design model is meant to be heuristic. Unfortunately, many people who use the design model use it algorithmically.

How can I be more creative in my job as an instructional designer?

First of all, you cannot separate your professional life from your personal life when it comes to creativity. You must try to achieve a creative level in every aspect of your life. You must have a vision for your life, a passion for everything you do.

Try to work on the following list of creative thinking skills.

Remember, it is difficult to work on more than one at a time so perfect one and then move on to another.

- Problem awareness and definitions: No creative thinking is likely to occur without recognition or awareness of a problem, some definition of the problem and commitment to work through it. Be persistent. Given a "mess" find the essence of the problem and write one sentence which can define the problem. Continue to generate possibilities of what the problem is; do not be satisfied with the first choice. (This is linked to the creative element "persistence.")

- Produce and consider all alternatives: The more alternatives a person or group produces or considers, the more likely a viable and successful solution will be achieved. **Do Not Be Judgmental.** That is, withhold judgement until all alternatives are produced. Keep open; resist premature closure, that is, don't judge and conclude too soon, don't jump to conclusions. Consider all the factors, look at the consequences, be very clear about objectives, assess the priorities, find all possible alternatives. (This creative skill is linked to "fluency.")

- Be original: Original = being "different"; 3 conditions support original thinkings: 1) allowing adequate time to produce alternatives; 2) playing with ambiguities and uncertainties (time to clarify); 3) heightening concern about the seriousness or importance of the problem. ("originality")

- Highlight the Essence: Abstract thinking involving a process of synthesis, discarding erroneous or irrelevant information, abandoning unpromising facts or solutions, refining ideas, establishing priorities, allowing a single idea or problem to become dominant. Be willing to give up on an idea and throw it away. Also be willing to set it aside and come back to it. ("flexibility")

- Elaborate: Successful creative problem solving requires that chosen alternatives be elaborated, plans for implementation be developed, but the initial alternative must itself be of value and related to the problem. Ideas expanded, plans and organization developed, selling of ideas all require elaboration.

- Be Aware of Emotions: Irrational, emotional experiences can lead to breakthrough illuminations. They can enhance rational processes and provide experiences and information useful in problem solutions. Play with analogies and metaphors, create books and create book titles. Creative dramatics and scenario writing promote and develop emotional awareness. Play with colleagues, role play, write a skit which includes the client as a character. Put ideas into context; look for and make clear the context, the "bigger picture" for ideas; make meaningful connections between individuals' ideas and the world in general.

- Combine and Synthesize: Integrate the disparate; bind the unbindable; reconcile the irreconcilable; force-fit parts that don't fit. From out of unexpected combinations, new and surprising revelations occur. This can be essence of creative illumination.

- Rich and Colorful Visualization: Richness = intensity and vividness; colorfulness = sensory appeal and unusualness; both relate to the ability to create, develop, conceive of ideas, concepts, processes, systems visually or through images. Use crayons and draw abstract pictures to convey the essence of the problem. Fingerpaint.

- Fantasy: Enjoy and use it as a means of bridging gaps, making new combinations, discovering the essence, finding deeper meanings, leading to new awareness and discovering new ideas, going beyond the expected and ordinary. What would happen if ...?

- Make it Sing --Make it Move: By stimulating kinesthetic and auditory awareness and involvement with an experience, a potential for a deeper grasp of the information occurs leading to the production of more useful and valid alternatives. New insights often occur by experiencing something through multiple sense modalities. Go away and do physical activity or do a circle back rub or practice yoga or tai chi as a group. Use abstract music to promote new creative thought.

- Look at it Another Way: Develop the ability to assume new and unusual perspectives. Often, breakthroughs come from those who see in new ways, ideas, etc., that have been viewed repeatedly from typical perspectives. Breakaway from habitual and practiced ways of seeing. Go a different way to work and actually look at your world. The story of Velcro is appropriate here. The person who invented it got the idea from taking burrs from his dog.

- Visualize the Inside: Look beyond the surface, seek the unseen or unknown, find the hidden aspects, examine the internal dynamics, open up a problem situation. This allows for the discovery of new, unusual ideas and alternatives. Create a mental image of the inside of the problem. Use mental imagery to create a fantasy world of the problem or of an ideal world.

- Let Humor Flow and Use it: Humor involves many of the elements of creative thinking such as synthesis of unexpected elements, surprise, unusual combinations, integration of social, personal, and psychological processes, insight, playfulness, fantasy, etc. Humor often leads to new views and unexpected insights into problems. Do not, however, ask humor to conform. It must be spontaneous.

- Get Glimpses of Infinity: This is especially related to developing and using a view of the future; learning to project ideas and self-perspectives into the future. Creativity is infinity; the future is waiting to be shaped by what we think and do everyday. (Torrance, 1979)

Although many of these suggestions seem esoteric at this time, you must keep an open mind. Remember to withhold judgement. Simply start by trying one of the skills for two weeks or until you feel comfortable with the skill. Then let it sit and try another. Hopefully, the first will "sink in" and will become a part of your repertoire. Continue to absorb a new skill every two to three weeks. In a year you will be on the road to creative problem solving. Simply being aware of the need for creativity and trying to become creative on a conscious level will help you to be more creative. You have already taken the first step--recognizing the need to become more creative. Perhaps your colleagues will see the difference and join the parade.

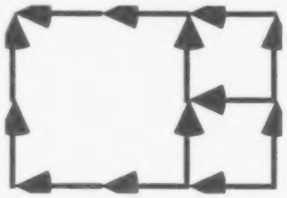
SOME POSSIBLE ANSWERS TO FLUENCY TEST:

bright (as in color)
easy (as in light task)
illumination (as in a bright light)
insight (as in seeing the light)
slender (as in light build)
example (as in a shining light)

ANSWER TO NUMBER OF SQUARES:

At least 30 squares, sixteen small squares, one large square, the upper left four squares combined are one square, etc.

ANSWER TO ARROW PROBLEM:



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Logical Reasoning: Without Pictures...Not Without Words

Maura J. Geisser

Introduction

A Picture is worth a thousand Words. . . but without those words can there be logical reasoning? Can there be such a thing as "pictorial reasoning", that is, logical inference in terms of visual/pictorial representations? Or is it the case that all reasoning requires a verbal/linguistic system of representation? This paper will address several questions, particularly concerning the possible role of mental imagery, as a form of visual/pictorial representation, in the inferential activities of the deaf. But, we first must be clear about the concepts of mental representation and mental imagery.

It is generally thought that all cognitive processes essentially involve "mental representations". If so, it is quite plausible to expect the ability to reason to be dependent on the capacity to generate and manipulate mental representations. At present there exists a controversy in cognitive psychology about what kinds of mental representation are possible. The two central types that are often mentioned are propositional (linguistic or descriptional) representation and visual (pictorial) representation. One dispute that has arisen concerns the cognitive role of pictorial representation. Kosslyn (1981, p.131-150, 207-244) reports, for example, that mental imagery is used to retrieve factual information about object properties or category relationships. And there is a suggestion in his and in others' writings, that visual representation and propositional representation are interactive parallel cognitive processes. One wonders then whether there are problems which are not solvable by the use of propositional representations alone, but solvable, or more efficiently solvable, with the use of visual representations. What is known, at least, or generally believed, is that some cognitive processes do utilize visual representations.

Since it is commonly held that linguistic/propositional representation exists and is crucial for much of normal thinking and reasoning, this will be assumed for the purpose of the following discussion. Thus, the main question for us is this: What is the role of pictorial representation, or mental images, in reasoning activities? This paper will consider this question particularly in reference to the deficits in reasoning skills that are often reported about the deaf. Our present concerns are primarily conceptual and logical, not empirical, although the discussion will refer to certain empirical studies.

The study of mental representation has progressed in recent years with the emergence of three major approaches. (1) The visual image representation theory (Kosslyn, Marr, Yuille, Ullman), according to which there is a distinctive pictorial/visual system of mental representations, separate from the verbal-propositional representation system, and it plays a distinctive role in cognition. Mental Imagery is thought to constitute such a system, and mental images are taken by Kosslyn to be "symbol–filled, visual–spatial arrays" with an attached description — that is, a kind of cognitive map. (2) The linguistic/propositional theory: on this view, all mental representations are, at bottom, linguistic/propositional, and even mental images are linguistically encoded. In short, there is no distinctively pictorial/

visual system of mental representation (Fodor, 1981; Pylyshyn, 1981)[1].; (3) a theory, such as Paivio's dual processing system (1986) which postulates two parallel systems, one visual/pictorial/imagistic and one linguistic/propositional. The two systems can function separately as alternative coding systems, or in an integrative fashion, as has been claimed in several psychological studies. According to Paivio, although an imagistic system could exist alone and there could be a combination of the verbal and image systems, the verbal/propositional system could not exist by itself.

For the present purposes we will assume that a visual/imagistic representation system exists. Our main question, then, is whether, and to what extent, the visual system can replace or supplement the linguistic system in the performance of certain cognitive activities, focusing in particular on inferential reasoning, especially when the linguistic system is defective or under–developed.

For the purpose of discussion, let us further assume provisionally, and contra the linguistic/propositional theory, that mental images are pictorial representations in order to see what consequences this has for explaining the inferential activities of the deaf. It has often been observed that the deaf depend, more than the hearing do, on visual imagery in their cognitive activities, and that, in particular, their reasoning is primarily, or substantially, visual/pictorial rather than verbal/propositional in nature. In fact, some writers speak as though pictorial representations, can constitute a language, a distinctive "visual language", that can support cognitive activities like reasoning. This raises all sorts of issues, some of which relate to the deaf's inferential performance — in particular, it opens the possibility of explaining their reasoning deficits on the basis of their reliance on imagery. In all this, there is this crucial question: **Exactly in what sense can we speak of "reasoning in pictures" or "using imagery in reasoning"? If the deaf depend on pictorial representation in their inferential activities, and pictorial representation cannot fully and efficiently support logical inference, this opens a possibility of explaining why the deaf experience difficulty in making logical inferences.**

Complex Structures

In considering these issues there is a critical distinction that we must make, and this is between reasoning **in** pictures and reasoning **with the aid of** pictures. In order to explain this distinction, however, we must begin with a general discussion of the nature of logical inference. The general notion of inference or reasoning involves a process of going from premise (or premises) to conclusion– that is, an inference must have a starting point and end point. Within a verbal / propositional / linguistic system, premises as well as the conclusion are, of course, sentences or propositions, namely items in the linguistic system of representation. It is assumed that in such a system each sentence has a **syntax** and a **semantics**: the syntax gives a "logical form", and the semantics determines what state of affairs, or fact, the sentence represents. Inference occurs when certain operations permitted by the "rules of inference" are applied to given premises, yielding another sentence (the conclusion). Rules of inference are defined over syntactical forms of representations; that is, the syntax determines which rules can be applied to the given representations, and what other representations result from such an application. An inference, like any other cognitive activity, is subject to *evaluation;* it is either "correct" or "incorrect"; "valid" or "invalid". What is it then that makes an inference correct and another incorrect? This is where semantics steps in. A correct inference is one in which the truth of the premises guarantees the truth of the conclusion. A rule of inference is *correct* if it can never lead from true premises to a false conclusion.

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[1] It seems that this propositional/ linguistic theory need not make a commitment to Fodor's Language of Thought (LOT) hypothesis, although some people like Fodor feel that this commitment is necessary.

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This is why the representations that can serve as items in an inference, as premises and conclusions, must have both a syntax and a semantics. **Without syntax, no inference rules can be applied to them, and without semantics, an inference cannot be evaluated as correct or incorrect**. With this in mind, let us consider again the question of "pictorial reasoning". This may mean inferential activities in which pictures (mental images) serve as premises and conclusions. That is, pictorial items constitute the *medium* of reasoning, and this is what I mean by "reasoning in pictures". On the other hand, by "pictorial reasoning", one may simply have in mind inferential processes in which pictures or images are used as a heuristic aid to facilitate reasoning. On the latter understanding, reasoning itself is still done "in" sentences or sentence-like items, and these constitute premises and conclusions, mental images being utilized only to facilitate movement from sentences to sentences. This distinction is crucial for the original hypothesis: whether pictorial representation is sufficient to make logical inferences possible, and what implication this distinction has on the processes of logical reasoning for the deaf.

Thus, for any representation system to support reasoning (that is, to be used as a vehicle, or medium, of inferential activities), it must have a syntax. Let us now consider what conditions must hold if a system of representations can be said to have a syntax, or form a "syntactic system". (i) There must be a set of syntactical primitives, i.e., basic elements of the language[2] (ii) There must be a set of rules that allow for combination of these basic syntactic primitives into more and more complex structures[3], including, in particular, items, such as sentences in a propositional system, that can be affirmed or denied, and therefore, can be semantically evaluated as "true" or "false", or as "accurate" or "inaccurate", etc. (iii) It is assumed that these rules are iterative – that is, they can be repeatedly applied to generate a potential infinity of complex representations. (iv) What gives a complex representation its "syntactic form" is its *generative history*, namely, the sequence of syntactic operations by which the representation has been generated.

Consider how syntax and semantics work in the case of linguistic/propositional representational systems. For any such system, the syntax can be characterized in terms of symbols belonging to a variety of classes corresponding to relations (such as: *on, under, before, after*), entities (*circles, dogs, tables*), properties (*brown, red, old, young*), and logical relations (*if-then, not, some, all*). Syntactic rules will allow us to combine these basic expressions into more complex expressions (i.e., *red circles, brown dogs*) including sentences (i.e.., *Some dogs sleep under the red table.*). Simple sentences are compounded into more complex sentences (i.e., *Some circles are red and some circles are brown.*), or, further (*When some circles are red, other circles are brown.*). What then is the role of semantics here? First of all, the semantics of the system must interpret, that is, assign a meaning to the system's syntactic primitives. For a verbal/linguistic system, this is done by convention. "Dog" means dogs in English, and that this is so is determined by linguistic convention. For all we know, the word "dog" could have been used to mean cats, and "cat" to mean dogs. Moreover, the semantics must include rules that allow us to assign meanings to the complex representations generated by the system's syntax. This means that there must be a close coordination between the syntax and the semantics of a system, expressed by the following rule, often referred to as the **Principle of Compositionality:** *If S is a complex expression built up from more basic expressions, S_1,..., S_n, by a syntactic rule R, then there must be a semantic rule R* that determines the meaning of(i.e., what is represented by) S on the basis of the meanings of S_1,... S_n.*

As an example: Consider the two sentences, "Spiderman is a human", "Ninja is a turtle". There is (in English, for example) a syntactical rule that says that we can form the conjunctive sentence, "Spiderman is a human *and* Ninja is a turtle". This is a well-formed, grammatical sentence. According to our earlier general characterization of representation systems, there must also be a parallel semantic rule that assigns a meaning to this compound sentence, and the Compositionality Principle requires that this be done in such a way that the semantic value (meaning) of the compound is determined by the meanings of the constituent sentences. In a formal logical setting, this rule is precisely the "truth table" associated with conjunction: it assigns the semantic value *true* to the conjunction " A and B" just in case the semantic values of A and B are both true and *false* otherwise.

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[2] Nouns, verbs, adjectives, and adverbs are often taken to be fundamental elementrs of language.

[3] For example, transformational grammar rules foppr forming compound sentences or sentences which contain relative clauses, adverbial clauses, nominalizations, noun clauses, etc.

Now, let us try to see how this can be applied to pictorial representations. For pictorial representations to constitute a language in which reasoning can take place, the following three conditions must hold:

(1) **There are pictorial analogues of sentences**; that is, we must be able to use pictures to make assertions, or statements, and to say something that is true or false.

(2) **These pictorial analogues of sentences must be capable of being syntactically compounded to generate more complex sentence analogues**. These operations will yield pictures with syntactic structures that can support formal rules of inference, rules that depend on the syntactic form of the pictures involved.

(3) **There must be semantic rules** that determine the representational contents (meanings) of these complex pictures on the basis of the representational contents of their individual constituent pictures.

Fodor and Pylyshyn raise questions as to whether pictures are "abstract" enough to be able to serve as vehicles for making true or false assertions -- that is, whether pictures, images, etc. can satisfy (1) above. But it seems clear that there are semantic analogues of truth that make sense for pictures: we routinely evaluate pictures in terms of such categories as faithfulness, accuracy, informativeness, and of course, correctness. And it seems to me that these semantic properties can support the notion of logical inference at least in a rudimentary way. Thus, valid or correct inference can be thought of as one in which these semantic properties, such as accuracy, are preserved from premises to conclusion. That is, a pictorial inference from pictures A and B as premises to picture C as conclusion can be said to be valid or correct just in case the accuracy of A and B guarantees that C is at least equally accurate.

Concerning condition (2): it seems that something like conjunction (*and*) can be made sense of for pictorial representations. Thus, if you have a picture of a dog and one of a tree, their juxtaposition could be considered a complex picture that combine the contents of the two pictures, much in the same way conjunction (*and*) combines the contents of two sentences. But how is it possible to represent such constructions as disjunction (**or**), negation (*not*), the conditional (*if–then*), the quantifiers (*all, some*) with pictures? It should be noted that these constructions and the quantifiers, in particular, are extremely difficult for the deaf child to comprehend. Notice that these constructions must be represented *pictorially*; that is, we must not use pictures surreptitiously as ersatz verbal expressions (*icons*): there must really be a picture of negation, **a picture that pictorially represents, the idea of negation.** Some might say this is to require of pictures to do what words do; pictures have their own unique syntax and semantics-- that they don't have to duplicate what the verbal medium does. In reply, we should note that we are here concerned with the question of whether pictorial reasoning might, for the deaf, substitute for verbal/linguistic reasoning. If this is to be possible, the former must substantially do the job done by the latter, and therefore, must be able to represent constructions, like *not, if-then*, etc.

But what is it for a picture to "represent pictorially"? This is the crucial question in assessing the significance of condition (3). It is of the essence of verbal/linguistic representation that the representation relation is established by **convention:** there is nothing intrinsic to the words "table" and "chair" that "table" means table, and "chair" means chair. We could have used the word "table" to mean "chair" and the word "chair" to mean "table", or anything we want. Linguistic convention which has evolved historically determines what means what. On the other hand, if there is such a thing as pictorial representation, representation by pictures, their semantics could not be conventional, or at least not wholly conventional. For the whole point of using pictures to mean anything is that there is a natural relation of some sort, specifically a resemblance or similarity relation, that determines the meaning, or representational content, of a picture. So, when we use pictures of a table and a chair to represent pictorially, they are not easily interchanged, because a picture must resemble what it is supposed to represent. This isn't to deny that there can be some conventional aspects to pictorial representations (such as sign language and universal/international road signs). But if you take away resemblance, you take away pictorial representation, or pictures as a vehicle of representation. So, the essential semantic relation for verbal-linguistic semantics is **convention**; the essential semantic relation for pictorial semantics is **resemblance**.

That representations in a pictorial system represent by resemblance applies to complex as well as to simple pictures. Consider now the possibility of introducing syntactic operations on pictures that are analogous with sentential operations of disjunction, the conditional, and the like. Remember that, for pictures, these operations, however they are defined must be pictorially represented by resemblance, not by laying down rules of convention, as in the case of verbal languages. In the case of verbal languages, a rule we adopt determines what the meaning of a complex representation is going to be; in a sense, anything we say is possible--it's a matter of decision, and adoption of convention. With pictorial representation, the situation is different: not everything we say is possible. The semantical rule we adopt must satisfy the further constraint: that the meaning it assigns to a complex picture is such that **the picture resembles what it represents (its meaning)**. In a sense, therefore, there is no need for semantical rules for complex pictures, because complex pictures are going to represent whatever they represent by the natural relation of resemblance. This makes conventional rules of semantics entirely otiose. All this makes it highly puzzling how pictures can form the kind of language that can function as a medium of logical inference. As previously mentioned, this issue is different from whether pictures or mental images or visualization can **aid** the reasoning process. The issue currently under discussion, rather, is whether or not there can be such a thing as real pictorial reasoning; reasoning done in pictures as the medium of inference.

Stephen Kosslyn

In this section, I want to describe an influential proposal by Kosslyn regarding mental imagery. His theory of mental imagery attributes both syntax and semantics to the system of mental images. I then want to examine my general claims concerning pictorial reasoning within the context of Kosslyn's theory: Can Kosslyn's theory provide a framework for pictorial reasoning?

According to Kosslyn, "images have two major components: the surface representation, which is a quasi-pictorial representation that occurs in a spatial medium: this representation depicts an object or scene, and underlies the experience of imagery; and second, the 'deep representation' is the information in long-term memory that is used to generate a surface representation." (Block, Imagery, 1981, p. 213) Kosslyn contends that, "the surface image depicts an object or a scene and the primary characteristic of these representations is that every portion of the representation must correspond to a portion of the object such that the relative interportion distances on an object are preserved by the distances among the corresponding portions of the representation." (Block, Imagery, 1981, p.213). He goes on to say, that, "therefore, size, shape, orientation and location information are not independent elements... According to Kosslyn none of these properties are shared by discursive propositional (symbolic) representations." (Block, Imagery, 1981, p. 215).

It seems that Kosslyn, et al., (1979) presuppose that any picture-like (analog) representational medium involves constituent elements which are construed to be a whole system of intrinsic properties connected by laws.

On Kosslyn's view, although pictorial representations are not propositions, they can be characterized as having a syntax and semantics. Thus, they are to be construed as constituting a language. How is this possible?

For syntax, Kosslyn (1990, p.86) claims that: the syntax of pictorial representations contains "symbols" which are composed of points and empty spaces, which constitute, on his theory, the syntactic primitives. Points and spaces are not independent in the account. What do syntactic primitives represent, if a space or point individually is taken from the whole? Some of the syntactical primitives' modes of combination are arrangements in 2D spatial arrays which combine into a single general mode of combination of spaces and points. A syntactic system, as earlier noted, must provide for generation of complex syntactic structures from syntactic primitives through a well-defined set of operations. What syntactic operations are allowed by Kosslyn? That is, how on Kosslyn's theory do pictures combine to produce complex pictures? The points could be arranged so as to produce continuous variations or to be spread out so as to be distinct.

Although Kosslyn, perhaps, is not wholly explicit in answering the question just raised, the permissible operations on pictorial representations in his theory apparently consist in their spatial arrangements in a two-dimensional medium, with their relative size, orientation and distance being syntactically significant features. In particular, unlike a verbal system in which special relation symbols are introduced to denote semantically significant relations, such as, "on top of", "to the left of", this is accomplished in a pictorial system by the spatial patterns and relationships that emerge from appropriate placement of pictorial elements in the two-dimensional space.

Thus, pictorial representations must be spatially organized in the process of accessing spatial arrays which are attributed in having a functionally coordinated space within a medium that functions like a matrix with a grain. (Kosslyn, 1990, p.74). On one hand pictorial mental representations are characterized differently from propositional representations. There is no explicit symbol that stands for a relation. Rather meanings of pictorial mental representations emerge from the juxtaposition of the symbols (pictorial images) or various dots and spaces on the matrix standing for the objects. Combinatorial rules are not defined over classes, only over particular objects.

The semantics of pictorial representations (or meaning as conveyed by individual symbols or combinations of symbols) entails a specific, nonconventional association between a representation and what it stands for, and in that sense it is not arbitrary. Thus, pictorial representations are often claimed to "resemble" the objects they represent. For Kosslyn, this comes to the requirement that: (a) Any part of the pictorial representation must correspond to a part of the the object represented; and that: (b) The distances among the parts of the representation must mirror those which correspond to the same parts or points of the actual object from a particular point of view. (Kosslyn, 1990, p.86). This spatial isomorphism between visual representations and the objects (or situations) they represent that Kosslyn's semantics requires is exactly a form of resemblance semantics, with resemblance restricted to spatial properties and relations. The resemblance enables us to "read off" the properties of objects represented from the properties and relations characterizing various parts of the representation. Points and spaces do not have independent semantics accounts or representations. When resemblance kicks in, it is because of a rich representation, to which resemblance has been applied as a whole, once the semantics is established. Then, the points and spaces can be thought to represent parts of a complex whole.

Here it must be explicitly and emphatically reiterated that the semantics of a linguistic representational system is set up by a set of **conventions**, whereas the semantical relation through which pictorial representations acquire meaning by some "natural relation", such as, resemblance. It is taken as the essence of pictorial representation that pictures represent objects or states of affairs by resembling them; if you take away "resemblance semantics" from the pictorial representation system, you take away what is distinctive about pictorial representation.

Criticisms/Objections

Kosslyn's semantics does generate the fundamental semantic notion of *correctness:* if the spatial relation as represented in an image does not hold in the object represented, namely when the spatial isomorphism between the visual representation and the situation it purports to represent breaks down, we have *incorrect* representation. This means that the point made by Fodor and Pylyshyn about the impossibility of applying truth to pictures is not wholly correct and does not constitute a barrier to the idea of pictorial inference–at least certain sorts of evaluation concerning the *rightness or fit* can be made for pictures. So, on Kosslyn's theory, the requirement that representations that figure in inference be *semantically evaluable* is satisfied. We could say: the inference from picture A to picture B is correct, just in case the correctness of A guarantees that B is (at least equally) correct.

It seems apparent, however, that Kosslyn's notion of syntax and semantics is very weak and that it fails to meet the previously stipulated conditions for languages or representational systems. It may be possible for pictorial representations to show something like conjunction, that is by taking two pictorial representations and combining them into one composite representation. Assume, then, that A and B have been combined by juxtaposition into a composite pictorial representation C. What is the semantics of C? We can say something like this: if A represents and object or situation **a** and B represents **b**, then C represents the composite object or situation, **a+b**. And something like the conjunctive rule of simplification for sentential logic (From P and Q, infer P) seems to hold true for pictorial conjunction: From a complex picture consisting of A and B we can correctly infer A. Semantically this corresponds to the following plausible principle: if the composite situation, **a+b**, obtains, then a obtains.

But, when one tries to pictorially represent the other logical functions, such as the conditional (if–then), negation, and the quantified sentences, it becomes difficult to even imagine how this can be done at all, based on Kosslyn's syntax of points and empty spaces. For example, consider the problem of combining pictures A and B into a disjunction C: supposing A represents a and B represents b, how could A and B be combined spatially to represent "either a obtains or b obtains"? Notice that the disjunction, whatever it is, must represent this disjunctive situation *pictorially,* that is by resemblance. Further, it seems difficult to conceive of how modal operators, like *necessarily, possibly,* and *sufficiently,* might be represented in pictures.

Thus, the major failing of Kosslyn's system of pictorial representation for the purposes of logical inference lies in the paucity of syntactic operations that can generate interesting semantic relationships. The only clear rule of inference that Kosslyn's syntax can support is the conjunctive rule of simplification which enables us to detach a part of the composite picture and "affirm it to hold", that is, if the composite picture holds. In saying this, we are granting, contra Fodor and Pylyshyn, that the notion of pictorial inference does make sense for Kosslyn's system. Therefore, we are only claiming that the inference system that is possible within it is an exceedingly impoverished one.

One might ask: But isn't ASL a sort of pictorial language? If we can make inferences in ASL, as we certainly can, then aren't the inferences at least partly pictorial? Although Kosslyn claims that the verbal/ auditory system can only process things sequentially or serially, this does not in fact take into account any visual natural language, such as American Sign Language (ASL). American Sign Language is a natural language, with a syntax and semantics, which is visuospatial, but not auditory by nature.

But, it would be a mistake to think that ASL is a true pictorial language; the truth is that it is an "iconic language" in Fodor's sense. Take an ordinary natural language, like English. For simplicity sake, assume that all the nouns are of picturable things and situations; similarly for verbs, etc. Anyway, replace each noun, verb, adjective, etc. with pictures (*icons*), leaving untouched only prepositions, auxiliary verbs, conjunctions (*connectives*), quantifiers (*some, all*), etc. What you end up with is an iconic language.

An iconic language has the following features: (i) Its syntax is identical with English or the underlying natural language from which it is derived. (ii) It has a resemblance semantics for the basic constituents (*semantic primitives*). (iii) Its semantics for complex representations (sentences, etc.) is *not* a resemblance semantics. This is especially evident if you consider negation: a simple iconic sentence A may resemble the state of affairs it represents, but we can't expect its negation, "Not A", to resemble the state of affairs *it* represents.

ASL is essentially an iconic language. Its basic "words" have a sort of resemblance semantics (gestures are supposed to "resemble" the objects or situations they represent), although even here convention plays a large role. In syntactic structure, ASL is just like any natural language. Thus, inferences conducted in ASL are not pictorial inferences— they are pictorial only in the sense that some of the "words" that may appear in the sentences involved in the inference have a kind of resemblance semantics. The question encourages the original hypothesis, that the deaf have difficulty with complex structures in any language, ASL or in English. Thus, ASL appears to be a hybrid language. Perhaps for some deaf children the use of such a hybrid may put further constraints on the already existing constraints on the syntax and the semantics of mental representations.

In addition, there are further issues and questions that arise in connection with the deaf and their inferential performance. The following three facts are widely recognized: (a) the deaf show clear deficits in reasoning, (b) the deaf show deficits in verbal language skills (at least in natural languages like English), and (c) the deaf rely more heavily on visual imagery in their cognitive processes. It is generally thought that (a) and (b) are connected; and our discussion has shown why that is so. What role does (c) play? How it would be possible to pictorially represent abstract (symbolic) concepts, such as: love, hate, friendship, and justice if this condition holds? What in fact would friendship look like? It is sometimes thought that the use of imagery can help the deaf to remove part of their linguistic deficits and facilitate inferential performance. That is possible, but there is also the opposite possibility: it may be that the deaf's reasoning deficits, and perhaps also their general verbal deficits, may be aggravated by their excessive reliance on visual imagery. They may be trying to do with pictures what can only be done with words. This is an a priori speculation, but the possibility cannot be ignored; more experimental study is needed to decide the issue.

Conclusion

Thus, in conclusion, it seems that, the question as to whether both pictorial representations and propositional representations are prerequisites for logical reasoning can be resolved. It is my contention that a propositional/linguistic representation system is a necessary condition for logical inference. That is, a deaf child must be competent in a natural language, perhaps ASL, in order to be proficient in deductive inference. As Loewer and Rey state, "In any case, even if some mental representations can be usefully thought of as images, it is extremely implausible that *all* (or even a significant proportion of) Mentalese representations can be. So far as anyone has proposed, images don't combine to produce *logically complex* images: What image represents that there are *no* green triangles, or that if someone loves everyone then everyone is loved by someone? Sentences seem to be the only physically realizable objects that have this expressive potential." (1991, pxxi – p.xxii.)

Thus, my overall conclusions are as follows:

Images, or pictorial representations, can at best play a limited, heuristic role in logical reasoning, and more generally in the processing of thoughts. A pictorial/visual representation system, whatever its role in general cognitive processes may be, is a poor substitute for the verbal/linguistic system as a vehicle of logical reasoning.

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CURRICULUM APPROACHES

Visual Literacy as the Basis for Writing Experiences:
A Summer Gifted and Talented Program

Sonja R. Darlington

Background

Introduction

This discussion about a writing curriculum based on integrating visual and verbal literacy begins in 1990 with the Iowa Governor's Institute for the Gifted and Talented at Iowa State University. The Governor's Institute was a three-week institute for 80 of Iowa's most talented students from grades seven through nine. These students participated in one of four courses: Artistic Design, Probability and Statistics, Archeology, and Environmental Chemistry. Classroom activities included four hours of intense subject-oriented study in the morning and one to two hours of writing in the afternoon. Students were nominated by their schools. Twenty students from the nomination pool were then selected for each of the four core courses. Tuition and residential fees were funded by the State of Iowa and Iowa State University.

Writing classes were designed so that students would learn how to communicate the ideas they had acquired in their core courses. Generally, the goal of the writing classes was to prepare a research project, and writing experiences focused on writing skills from freshman college-level courses, specifically English 104 and 105. Therefore, while the writing class for Artistic Design attempted to base its curriculum on theoretical concepts from art and design, the writing program emphasized a composition agenda based on verbal thinking. And even though students were encouraged to read articles on Kandinsky, Oldenburg, and O'Keefe, and even though discussions were based on topics such as women in art, spirituality in art, and art criticism, the writing program did not provide the support that the Artistic Design instructors had anticipated. They were interested in a writing curriculum which helped to develop students' visual thinking and supported a New Art Basics Curriculum.

New Art Basics (NAB) Curriculum

The New Art Basics Curriculum developed by ISU professors Dennis Dake and John Weinkein emphasized seven content areas: preparation for visual thinking, basics of visual thinking, metaphoric thinking, visual logic, plus art defined by its human contexts, cultural contexts, and historical contexts. The theoretical base within the seven content areas for NAB included current knowledge of visual and creative thinking, graphic ideation, multicultural/nonsexist education and the study of art history and cultural contexts. After successful statewide NAB programs in over 70 Iowa schools, the three-week Iowa Governor's Institute provided another possibility for NAB implementation and development. The curriculum for the three-week program incorporated activities that were developed from NAB strategies tested in Iowa classrooms, elementary through university. Artistic Design students were exposed to over 25 strategies during the Institute. All of the strategies helped students to expand their knowledge of visual thinking and of individual art production.

An Interdisciplinary Approach

Integrating a visual and verbal curriculum

To combine the three-week NAB curriculum with a writing program was a formidable task. Both ISU art and English faculty had separate goals for the writing class. A satisfied Artistic Design faculty depended on a writing instructor who understood the NAB project and its objectives. To the Artistic Design faculty, 104 and 105 writing objectives were less critical than the NAB goals and objectives for improving visual literacy. A meaningful and effective writing experience for students depended on some agreement between the two disciplines—for middle school students have little formal practice in combining visual and verbal knowledge. Therefore, a productive writing class depended on a compromise between the knowledge and experience generated by both areas. For the next Iowa Governor's Institute in 1991, a qualified curriculum specialist was given the charge to become the writing instructor and provide an interdisciplinary approach. Following some discussions in which the curriculum specialist tried to accommodate both departments, they settled on three overarching themes which would provide the focus for the writing curriculum: personal involvement, critical visual and verbal responses, and integration of visual and verbal knowledge.

Specific Writing Goals and Assignments

To follow through on the three themes for the course, specific writing assignments were based on five areas of concentration: freewriting, log entries, poetry, prose, and professional writing. First, freewriting concentrated on generating visual and verbal ideas. Students practiced by writing for five to fifteen minutes without a specific topic and without editing. Second, log entries concentrated on visual and verbal thinking and looking with a critical eye. Students practiced by describing an artwork which represented their personality and by writing a response to a sculpture entitled, *Left-Sided Angel* (De Staebler, 1986). Third, poetry concentrated on promoting visual thinking, visualizing an environment, experiencing a visual environment, perceiving multiple-visual perspectives, and focusing on metaphoric thinking. Students practiced by writing a sestina about art, two free verse poems, a multiple perspective poem, and a four-stanza poem on a metaphoric face strategy. Fourth, narrative prose concentrated on recognizing the gestalt. Students practiced by writing an enlightenment story based on *Zen and the Art of Burglary* (Suzuki, 1959). Finally, edited and revised professional writing concentrated on producing visual and verbal analysis. Students practiced by writing a critique of a work at the Des Moines Art Center. Students in the 1991 Art and Design writing clinic worked diligently on more than fifteen writing projects during the three-week session. Many of the fifteen projects which supported the NAB curriculum are described in the following section.

Student Writing Samples

Generating Ideas: Freewriting

Artistic Design faculty decided that one of the critical objectives during the first several days of the Institute was to teach art students how to generate ideas based on visual thinking. NAB strategies which encouraged students to move away from traditional approaches to visual thinking included *Combinative Leap Frog, Think Like a Group, and Combinative Grid,* NAB Strategies #VT 46, #VT1, and #VT2B, (Dake & Weinkein, 1990). The purpose of each of these strategies was to teach students to disassociate themselves from their visual thinking based on conventional images such as dragons, skeletons, and cartoon figures. In most cases, students were successfully weaned from their previous visual ideas and experimented with generating new ones.

Prior to helping these same students begin to make connections between visual and verbal thinking, the first activity in the writing class involved learning about an invention process which would help generate ideas. Students read about freewriting in *Writing Without Teachers* by Peter Elbow (1973). Freewriting involves writing for five to fifteen minutes regularly without stopping even to lift up the pencil. Elbow argues that freewriting encourages students to participate in "babbling" or "jabbering" exercises. Moreover, freewriting helps students separate the act of producing from editing, so that writers become increasingly less inhibited during the invention process.

During the first week of the Institute, students participated in at least three five-minute freewriting exercises. A popular freewriting activity included students receiving a sucker and writing about it in every other sentence. Several students had expressed a fear of writing, and the freewriting exercises helped them to become less intimidated by the daily writing program. As one student noted on her final written evaluation: "I would have liked to do more freewriting, writing whatever comes to mind. Because it doesn't seem stressful. It's relaxing." Many verbal comments during the writing program reiterated the same feeling—that writing was surprisingly fun and relaxing.

Generating Visual and Verbal Thinking: Artist's Log

Aside from using freewriting to help art students generate new ideas, students also started an Artist's Log. In contrast to freewriting, which focused on "anything that enters your head" and had little structure, the purpose of the Log was to encourage writing about a given topic involving both visual and verbal thinking. For example, the first entry was on an NAB strategy, #HM2, which involved students finding an artwork to represent who they were (Dake & Weinkein). After locating a work, they had to show the piece to the class and make comparisons to their personality. Based on this activity, students were asked to write about the picture in writing class. They were given ten minutes to make their entry. Brad, a ninth grader with very little writing experience, made the following entry in his Log:

> I found a picture by Robert Gross. I don't remember the name of the work. . . .This was a pencil drawing that started very simple and plain on the outside and as it worked its way inward it became more detailed. I

> said the picture relates to me because sometimes I can be simple and dull on the outside. But on the inside, I can be complicated (Log Entry #1).

As Brad's writing demonstrates, the Log entry encouraged him to direct his visual thinking to the artwork.

Looking with a Critical Eye: Artist's Log

Aside from improving students' ability to generate visual and verbal ideas, another goal was to focus on looking at art with a critical eye. In order to write log entry number #6, *Learning to Look*, students took a short excursion during their writing time to the ISU Parks Library. The purpose of the visit was to look at the *Left-Sided Angel*, an outdoor sculpture by Stephen de Staebler (1986). Outside in the warm afternoon sun, students were asked to make a Log entry based on four topics: description, analysis, interpretation, and judgment. Following a brief discussion of the four criteria, students were given approximately fifteen minutes to write about the four aspects. Excerpts for two of the criteria follow:

Analysis, by Julie, an eighth grader:

> I've never understood the word composition. But here goes.The sculpture is composed of a shaky-looking human body. The body has no arms except for an odd-looking wing raised strangely above his head. He is balanced on his left toe. He stands in a tall vertical line with his right side sticking out. The green color of the statue blends in well with the trees hovering around it. The choice of a tall cement pedestal is a great because it accents the vertical lines.

Judgment, by Lara, an eighth grader:

> I like this statue especially because it is broken, cracked, and worn out. Yet, it still stands tall. It is not beautiful and has received much criticism, and yet he still stands looking over us with a forgiving face. To me the statue symbolizes strength, hope, and endurance.

As these entries suggest, students had a difficult time understanding the terminology. Julie notes in her entry for analysis that she is puzzled by the concept of composition. In other log entries, particularly in the excerpts on judgment, students noted their frustration with trying to make evaluative statements. As Lara expresses in her judgement section, she "likes" the statue for its symbolic meaning. In many entries, judgment was often a statement of personal taste. Even though these concepts were explained in the art class and reinforced in the writing class, students needed time to develop the ideas in their own minds.

Imagining the Visual Professional: Artist's Profile

In one of the first assignments during the Institute, students were asked to write a brief profile of a classmate. The purpose of the writing task was to encourage students to imagine each other as respected artists and to produce an article advertising a show in their local community. To help them think about each other as professional artists, students were told that the profiles would be displayed along with their artwork in the Institute Art Show at the conclusion of the three weeks. Following a week of strenuous effort that included three drafts, peer editing, and a final editing by the teacher, students had their profiles typed and ready to accompany their artworks.

Many of the profiles included a background on how the student as a young artist became a professional. For example, Lara writes about her friend, Michelle, who is an eighth grader:

> Michelle was born in Waverly, Iowa. Her interest in art was the result of the encouragement given by her parents and her aunt, who is a graphic designer at Wartburg College in Iowa.

A second example is a humorous entry by Rob about his friend Andrew, a ninth grader:

> As a young child, Andrew showed tremendous artistic ability. In the second grade he made a large crayon drawing of a red balloon with a strange man who had tremendously large ears. Dumbo size! His teacher enjoyed the picture so much that she had it laminated. Since her lamination in 1982, Andrew strived to meet the standards of that first masterpiece.

Both entries suggest that early parent and teacher enthusiasm encouraged and respected students' attempts to become artists.

Promoting Visual Thinking: Poetry

To help art students pursue visual thinking in groups and to encourage creative thinking strategies, students were introduced to poetry exercises during the first week. Students read aloud John Ashbery's *The Painter* (1962) and were introduced to the "sestina." Following a very brief analysis of the six stanza form, students were asked to pick six terms they had discussed in Artistic Design. They chose: composition, values, visualization, sketches, medium, and texture. After the six words had been chosen, students divided into six groups and each group wrote a stanza with six lines and the six art words at the end of each line. Following the form of the sestina, the art words had to be organized into a specific order: first stanza, 123456; second stanza, 615243; third stanza, 364125; fourth stanza, 532614; fifth stanza, 451362; sixth stanza, 246531; and the seventh stanza, 123456. In the seventh stanza, the chosen words appear in the middle and at the end of the three line conclusion.

A particularly good example of a sestina stanza was written by group six. Value, sketch, texture, medium, visualization, and composition were organized into a pattern of 246531. They wrote:

> I saw unleashed blue bleed in varying
>   values
> It washed over the remnants of my
>   sketch
> My brown brush flew, creating its
>   texture
> My canvas reaped rewards from this
>   medium
> Ghostly memories, my life's
>   visualization
> My canvas, my life, neither have
>   pleasant composition.
>
> – Andyashleyseth

Visualizing the Environment: Poetry

In addition to promoting visual thinking ideas from terms discussed in art class, students also generated new ideas from their surroundings. Several free verse poetry sessions took place in the Art and Design building rather than in the English classrooms on ISU campus. One such assignment was based on Kenneth Koch's teaching ideas in *Rose where did you get that red?* Koch (1973) uses William Carlos Williams' *The Locust in Flower* (1938) to suggest that this poem is a series of individual words—comparable to brushstrokes in a painting. Each word adds to what one sees and at the end of the poem an art object is identified.

To get art students to think of words as brushstrokes, Williams' poem was read aloud several times and an explanation was given as to how each word built up the image in his poem. After a brief discussion, students wrote their own poems. The following example describes an object in their environment.

In
my
pencil case
  hard
  dull
  gray
wood
worn down
lead
  a 6B
  drawing
  pencil
for art.
–Laramichellescott

Other poems described a ruler, decayed leaves, a mind, and a baby carrot. All of the images were from objects found in the art classroom.

Experiencing a Visual Environment: Poetry

Another writing activity involved writing a free verse poem about the visual environment in a local junkyard. Art students had made a field trip to the junkyard in order to generate ideas for art studio projects. At the site, they took photographs of what they saw. Later, when the photographs had been developed, students chose particular pictures from which they made sketches for their individual projects. At the same time, students were asked to look at the photographs and write poems based on yet another suggestion by Kenneth Koch in *Rose where did you get that red*? Koch used William Carlos Williams again to suggest how students mights write a poem about an object that was not supposed to be beautiful but secretly the viewer thinks it is.

Following Koch's ideas, students were asked to think about their visit to the junkyard and, if necessary, to use the photographs to remind themselves of objects, such as hubcaps, garbage, a bent axle, and a broken windshield, which appear ugly at first and then upon closer observation appear beautiful. A "Between Junk" poem represents the work from several students.

Broken, slashed
cut and sharp
clear with patterns
webbed fluently
busy rhythm
beautiful
sparkly
shattered glass.

–Andyashleyjosh

The short poem describes a broken windshield that students found amidst the rubble in the junkyard.

Perceiving Multiple Visual Perspectives: Poetry

Still another example of poetry is based on Wallace Stevens' *Thirteen Perspectives of a Blackbird* (1923). Following a reading of Stevens' poem and a brief discussion of the different approaches to the thirteen stanzas, students were divided into four groups. The purpose of the groups was to write poems about objects from different perspectives. Two of the groups wrote about a Chinese silk scarf and another two wrote about a small globe hanging from a cord. The instructions specified that each group write four stanzas focusing on four traits: accuracy, order, emotion, and fantasy. These terms and their definitions were included in the reading packet supplied by the Artistic Design faculty. The qualities were defined as a description of an object seen by the artist, a description of the arrangement of things, a description of the feelings evoked from the viewer, and a description of the unreal world of the imagination, dreams, hallucinations, and visions.

The following poem is an example from a group of students who wrote about the silk scarf.

The bland scribbles and slashes
Of the mysterious language
Are shapes
And painstakingly done.

The black characters
Are in fine straight rows
Sometimes interrupted by a blood
red symbol
That is abstract
And in no order.

Through the dark black figures
A feeling of darkness and death
comes over you
And the boldness of the symbols
Describe something sinister.

Long before humans even existed
The silk worms roamed the earth
Making cocoons in which to live
And which later became the source
of silk
In which this scarf was made.

–Joshlararobscott

As the poem demonstrates, the four stanzas are organized around distinct perspectives which provide the focus for each stanza.

Focusing on Metaphoric Thinking: Poetry

A final example of poetry is based on a NAB strategy called Metaphoric Face, #MT59, (Dake & Weinkein). In art class students are directed to superimpose images one on top of the other in the shape of a face. As the images blend together, students make a sketch of their face on a large piece of paper. Following the sketch, the groups of students who collaborated to sketch their particular face apply paint to the surface. The activity takes several days to complete. By using the *Metaphoric Face* images, the same groups of students are asked to write a poem about their painting. The students receive instructions that the first stanza is a description and should focus on the shapes within the painting. The second stanza incorporates feelings of emotion and students are encouraged to translate their emotions into rhythm in the stanza. The third stanza recreates a fantasy and students are instructed to focus on proportions. They may use hyperboles (exaggeration) or litotes (understatement) to represent their visual image. The fourth and last stanza is a psychological profile and students are encouraged to focus on one particular characteristic which receives emphasis in the painting.

An example of the third stanza on emotion which accompanies a *Metaphoric Face* painting is written by Ashley, a ninth grader:

> I felt sorry for the creature. It was
> alone and afraid. As I reached out
> my hands to help, I got pulled into
> the picture. I was hot and on fire and
> I began to sweat in colors of blue. I
> tried to get out, but I felt a pulling
> coming from some strong force. Tug.
> Tug.

Recognizing the Gestalt: Narrative Prose

During the course of the three weeks, students were encouraged to be flexible in their thinking. Students often marvelled aloud at the contrast between their notions of art that they brought to the Institute and the detailed background provided by their NAB teachers. To raise students' awareness of the changes that had been taking place in their thinking about art, a narrative prose activity directed their efforts at examining their development. On one of the final days during the third week, students read aloud *Zen and the Art of Burglary* by Wu-tsu Fa-Yen (Suzuki, 1959). The short narrative is about a boy who wishes to follow his father in becoming a professional burglar.

Following a short discussion of the son's escape from a burglary and his sudden enlightenment, students are asked to consider their own enlightenment: a moment when they perceived a larger purpose or gestalt. Students are encouraged to talk about specific "Ah Hah!" experiences. In the subsequent writing assignment, students narrate a story about their personal development in understanding art. Students' examples of enlightenment include learning that "messing around with inspirations" can mean creating "something wonderful," and learning that "the art world isn't as easy as sitting in a chair." Many of the enlightenment stories were tales of woe and, if one were not familiar with students' sense of exaggeration, art faculty would really be guilty of "cruel and inhumane treatment" of students.

A fine tale of woe and subsequent enlightenment is described by Bob, a ninth grader. He begins his enlightenment tale by noting that he chose to do a painting project because it looked easy. On the first day he learned that "the amount of pressure needed to apply the thick tarrish pigment, gave him a hernia." So, when he received no guidance from his art instructor as to how much water he needed to dilute the pigment, he put a few drops of water into a huge bucket and used a brush the size of a mop to begin his painting. Although he attempted to paint with precision, "torrents of blue paint cascaded down his paper. . . .Once the floods dried, there were acres and acres of destruction covering the piece of art." However, as smart as Bob was, "he attempted to paint over the dried paint and, by golly, it worked. From that day on, he held celebrations on each anniversary of the discovery that he could cover painting mistakes."

Although the seriousness of the enlightenment stories can be debated, the discussion of understanding and utilizing new art concepts was a critical one. The open exchange on the topic of enlightenment at the conclusion of the Institute allowed students the opportunity to examine the experiences which had frustrated them in the NAB program. As a writing activity, the Zen story, along with the freewriting assignments, were the two most popular activities. Students enjoyed the relaxed environment of the freewriting experience and the storytelling qualities of the Zen story.

Visual and Verbal Analysis: Prose writing

In the final writing project for the three weeks, student struggled with understanding "analysis." As part of the out-of-class activities, students visited the Des Moines Art Museum. They were directed to study their favorite piece and write about it by using description, analysis, interpretation, and judgment as the focus for four in-depth paragraphs. The following day, students were asked to write their first draft for their last writing assignment. To provide students with more specific guidelines, they were instructed to use the title: *An analysis of Color, Texture, and Line in* [and the title of their piece]. A sample paragraph for color, texture, and line will suggest the improvement that many students were able to make. ***An Analysis of Color, Texture, and Line in*** Forms Derived From a Cube by Sol LeWitt: Angie, a ninth grader:

> Along with the structure of the lines, the colors were also very bold. The color scheme seemed to highlight the painting. It was actually an ink wash. The vibrant colors were both primary and secondary. Some additional colors were magenta, turquoise, white, black, and a shade of dark brown. Many times these colors were placed with their compliments. All of the bright colors coordinated and gave a feeling of excitement to the piece.

An analysis of Color, ***Texture,*** *and Line in* To All Gates *by George Segal:* by Becky, a ninth grader:

> However, the texture of the sign and background is uninteresting, while that of the people is rough and looks like it is dripping. The plaster was allowed to run freely in some of these areas. In others, it was left in its natural, rugged way—like oatmeal. The faces of the figures have been smoothed to be expressionless, their eyes and lips are sealed shut. The contrast between the two textures is very noticeable and draws one's eyes towards the travelers.

An Analysis of Color, Texture, and ***Line*** *in* Amazing Juggler: Seth, a ninth grader:

> The lines on the canvas are smooth and precise. The forms of the lines are very geometric and angular in contrast to the looseness of the textures. The lines are straight and confident, not sketchy. The lines that shape the juggler's arms are straight and sure and keep the roughness confined to their strong boundary. In the upper right hand corner there are geometric angles and squares that are formed by powerful midnight black hues. They serve to efficiently break up the space in the corner.

In addition to the Artist Profile, this assignment helped students to develop an appreciation for the editing and revision processes in writing. Both assignments involved at least three drafts, peer editing, teacher editing, and a revised final draft. For eighth and ninth graders, the experience of visual and verbal analysis challenged their understanding of the professional life of both artist and writer.

Benefits of a visual and verbal literacy program

As the Institute came to a close, students participated in an Institute Art Show on the final day. Along with two studio pieces from the Artistic Design class, students were able to show their parents and friends lots of writing examples. Their work included a bound Artist Log, poetry examples, an enlightenment story, and two typed and edited works: an *Artist Profile* and *An Analysis of Color, Texture, and Line*. Students went home to their respective schools with many new ideas about the connection between visual and verbal thinking. As eighteen out of twenty students noted in their evaluation, the writing class had been a worthwhile experience and they would recommend the program to their friends. Most importantly, however, in addition to the beneficial experience that the individual students received, the program demonstrated the fruitful integration of a visual and verbal curriculum. Indeed, visual literacy could provide a basis for writing experiences.

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Connecting the Visual and Verbal: Adolescents and Picture Book Production

Landra L. Rezabek
Maureen C. Noonan-Moore

Proponents of visual literacy note that picture books represent a natural means of stimulating discussion about both visual and verbal communication when working with children (Kiefer, 1988; Lacy, 1986; Stewig, 1988). However, the advent of adolescence often marks the end of young people's exploration of the ways in which visuals and verbals work together to facilitate communication. This paper describes a six-week long series of lessons designed to provide eighth grade students with opportunities to explore the link between visual and verbal communication using the production of picture books as a catalyst. This paper outlines the series of lessons based on the work of Melton (1985), discusses examples of student-produced picture books, and provides insight into students' thoughts and experiences while integrating their visual and verbal communications skills when writing, illustrating, and producing their own books.

Visuals and Verbals in the Art Classroom

The students in Mrs. Maureen C. Noonan-Moore's eighth grade art classes at Swanson Middle School, Arlington County Public Schools, Virginia, were curious one Friday when their teacher announced the next project. They would be writing, illustrating, and producing their own books. The six-week project, outlined below, was introduced to approximately fifty students in two classes of eighth graders during the spring of 1991. Students represented a variety of backgrounds, including Afro-American, Asian-American, Caucasian, and Hispanic. Some of the students had limited English proficiency and others represented special needs populations. The number of girls and boys enrolled in eighth grade art classes was approximately equal, and students primarily came from middle-income homes. Eighth grade art was an elective course, and students taking the class were not required to take any prerequisite art courses before enrolling.

Swanson Middle School, grades 6, 7, and 8, had just been reorganized from Swanson Intermediate, grades 7 and 8, and teachers were committed to the idea of helping students integrate knowledge, skills, and attitudes across the curriculum. Though Mrs. Noonan-Moore designed and conducted the project in her art class, she received input from her colleague, the reading-writing specialist, Mrs. Sandra L. Green. Future plans call for more collaboration with language arts teachers as well as with the computer teacher, so that students may use word processing to compose the verbal component of their books.

As evidenced in the project plans below, students integrated knowledge and skills from a variety of "subject areas" when completing the project. Students formed their own publishing companies, which demanded group work and interpersonal skills. As part of the publishing company activities, students also filled out job applications, wrote contracts, and learned to work under deadlines. The publishing company structure called for students to become peer reviewers of both visual and verbal forms of fellow students' work. Basic elements of a story and good writing techniques were discussed in class and students submitted written drafts to their student editors. Visual layout and design principles were presented, and students again worked with peer reviewers to improve their illustrations. The process of bookmaking required planning ahead and following directions to create a finished product. Though this project took place in the art classroom, it demanded that students develop and demonstrate their knowledge and skills in a variety of areas in order to produce books that communicated their messages in both visual and verbal form.

Project Plans

The following are the original plans and outline for a four-week project that, in actuality, required a six-week time frame when taught during the spring of 1991. These plans are based upon ideas suggested by David Melton in his book, *Written & Illustrated By . . .* (1985). The goal for the project: "Eighth grade students will write and illustrate their own 16 page books. The project will take 3-4 weeks culminating with an author's/ illustrator's reception for participants, parents, staff, and guests."

Lesson Outline

Friday before project begins (prior to bell)
- Announce project
- Dismiss class
- Answer no questions (students will be curious, but too much information too early will worry them)

Monday, Week 1
- Present personal book favorites (variety of authors, styles, types, etc., give brief synopsis, about 20 books)
- Have students give brief synopsis or title of one of their favorites

Tuesday, Week 1
- Form publishing company
- Have students fill out job applications
- Have students fill out book contracts
- Write story synopsis

Wednesday , Week 1
- Establish editors and art directors
- Present basic elements of a story
- Read 3 Little Pigs (relate to basic elements)
- Explain "power of the white"
- Begin story writing

Thursday, Week 1
- Discuss qualities of good writing
  - Grab attention
  - Character — introduction
  - Time and place
  - Mood
  - Character's motivation and mindset
  - Detail
  - Dialogue
  - Style
- Continue revising rough draft, so it will be ready for first submission to editor at next session. If necessary complete rough draft for homework.

Friday, Week 1
- Present proper editing techniques, approaches and symbols
- Students edit manuscripts
- Return manuscripts to authors; authors review editorial comments and revise as necessary
- Give students art supply list (supplies needed by Tuesday)

Monday, Week 2
- Recopy stories
- Remind students to bring in art supplies tomorrow

Tuesday, Week 2
- Demonstrate method for drawing layouts in miniature
- Students layout pages 0-15
- Students begin illustrations
- Students are to complete at least 2 illustrations by tomorrow's class

Wednesday, Week 2
- Discuss function of art directors
- Discuss way to improve drawings
  - Emphasis
  - Simplification
  - Shadow
  - Color
  - Detailing
- Have art directors and illustrators confer
- Prepare manuscripts to go to the typist
- Continue working on illustrations

Thursday, Week 2
- Continue work on illustrations
- Conferences with art directors

Friday, Week 2
- Discuss and display good book jackets
- Show students how to lay out book jackets
- Students design jacket fronts
- Students complete jacket fronts and all illustrations for next session

Monday, Week 3
- Students edit typed manuscripts
- Students prepare final pages for typing, marking pages as to where text belongs
- Discuss elements of book jackets
- Begin designing/writing book jackets

Tuesday, Week 3
- Finish book jacket elements
- Editors review copy of jacket
- Art directors review illustrations of jackets

Wednesday, Week 3
- Measure and mark book jacket paper
- Review illustrations and text with layout of text sheet
- Neatly number pages 0 through 15

Thursday, Week 3
- Discuss elements of title pages
- Begin work on title pages

Friday, Week 3
- Discuss half title page and closing page
- Begin work on these pages
- Title, half title, and closing pages are to be completed by next session

Monday, Week 4
- Trim all book jacket elements
- Glue in place all book jacket elements
- Be sure all pages are properly labelled and match layout sheets

Tuesday, Week 4
- Fold and line signature sheets
- Gather and label and number pages
- Carefully trim all finished pages so they are ready for use at the next session

Wednesday, Week 4
- Paste trimmed pages to signature sheets
- Gather pages in correct sequence

Thursday, Week 4
- Sew pages together
- Add book jackets
- CELEBRATE!

Project Results

When Mrs. Noonan-Moore first announced that students would be producing their own books, the young people didn't think that they could accomplish the task. Students were quite apprehensive and would have panicked, but the teacher found that if she only revealed bits of the project at a time and helped students tackle the assignment piece-by-piece that the students were successful. In fact, during one classroom visit by an outside observer during the fourth week of the project, students appeared quite confident in their bookmaking ability and described their accomplishments with enthusiasm. Students shared their work with pride, regardless of how far along in the project they were. They rattled off technical terms such as *half title page* and described the type of artwork they had chosen to illustrate their books. Students talked about the creative process, some indicating that they had seen the pictures in their minds and had written the story down and others describing how the words had come first and then they had thought how visuals could support or extend the stories. Regardless of how students engaged in the process, they were all proud of their products.

The books themselves reflected a variety of student interests and abilities. Book topics included poetry, fairy tales and fables, autobiographies, adventure tales, fantasy and science fiction, war stories, real-life reflection — both serious and comic, animal and pet stories, ABC's, and social issues. Students were not restricted to any particular number of words or pictures, nor were both words and pictures required, though in this particular semester all students used both forms of communication. Some students relied on text to carry the message, while others included very few words in their books and let the visuals tell the story. Some students designed books with words on one page and pictures on the facing page, while others integrated the visual and verbal content. Students had to make choices in the transfer of the story line from the textual to the visual, or vice versa, and the choices they made resulted in a variety of products.

When illustrating their books, students appeared to select a medium with which they were most comfortable. A majority of the students used felt tip markers and colored pencils, though watercolor, chalk, crayon, and cut paper also were used. Some students relied heavily on the use of color, while others avoided color illustrations because black and white visuals more appropriately supported the mood of the books. Some students concentrated on realistic detail while others used visual abstraction. Students who felt more confident in their artistic abilities tended to include more illustrations. Students also appeared to be thinking ahead as they designed their books in order to avoid potentially frustrating visuals. For example, it appeared that many students did not draw human figures if they could illustrate the story using other visuals. Students also avoided drawing human forms by using cut paper illustrations or abstract drawings. Students wanted to include visuals that would be easily recognized by others and chose to include visual content that they felt they could communicate effectively.

Though not an initial part of the unit plans, the bookmaking project sparked an idea in the reading-writing specialist's mind. Mrs. Green arranged for the art students to visit other seventh and eighth grade classrooms and show off their books. Students who read the books then shared their thoughts and observations with the authors/illustrators. From students' written comments to the authors, the books were well received. Student critiques mentioned both visual and textual content of the books and were quite supportive. As a result of these class visits, the bookmaking project crossed grade levels as well as scholastic disciplines and generated a great deal of interest in visual and verbal communication around the school.

In Retrospect

This is the second time Mrs. Noonan-Moore's eighth grade classes have produced illustrated books, and both times have been successful from the teacher's and students' perspectives. From the teacher's perspective, a crucial consideration is that teacher and students trust each other. As mentioned above, the project initially sounded formidable to students, and this would not be a good activity for the opening weeks of school. But by late in the semester, students had learned that, if they would follow the plans and directions given in art class, they would succeed. Students were therefore willing to take the initial risk with the book production project. Students also needed to trust each other since they served as editors and art directors in their publishing companies. A teacher needs to know his or her students quite well before undertaking this project. The artistic abilities of students are not as important as the social and interactive aspects of the class in a project of this type. Students need to be somewhat mature, self-directed, and willing to work cooperatively, and even this successful art teacher asserts that there are some years when she would not include this project due to the make-up of the class.

A second consideration is to elicit support from parents and to make sure parents as well as students are aware of the necessary commitment to the project. Parents signed the publishing company contracts, acting as attorneys for the student author/illustrators. The students' six-week grade was determined by their books, and parents were encouraged to provide input if approached by their child. Even with the overall success of the project, some students chose not to complete the project, but both parents and students were aware of the consequences throughout the entire six-week period so that no problems arose at the end of the grading period.

A third concern is the availability of materials to complete this project, as the total expense involved in securing paper, cardboard, glue sticks, paints, markers, needles, thread, and other supplies is considerable. A teacher needs to plan to include the necessary items in the yearly budget, write a grant, or request that students supply their own materials, though the latter option has not proved to be a reliable alternative in this teacher's experience. If the writing, illustrating, and production of books becomes a cross-disciplinary project, inter-departmental or administrative funding may be available.

Another consideration is that the project will most likely take more time to complete than the teacher initially believes, as evidenced by the revision of lesson plans from a four to a six-week time frame. It is important to allow students time for planning, time to receive feedback from act directors and editors, and time to revise visual and verbal plans before moving on to the production phase. Students also should be encouraged to work on their projects at home, and short-term as well as long-term deadlines can be set to help students pace their work.

Finally, this project may even intimidate an art teacher and somewhere in the middle of the project teachers may question their wisdom in undertaking such a task. Mrs. Noonan-Moore encouraged teachers to maintain their confidence and enthusiasm, particularly in front of the students, because ultimately the results of hard work, effort, and planning will become apparent. A closing example of the success of the bookmaking project is that young people share their books with people besides their immediate classmates and family. One eighth grader in the 1991 art class had already read her friend's book which had been produced in a class two years earlier and the students was now looking forward to making a book of her own.

The opportunity to write, illustrate, and produce a book is seen as a special activity and the books themselves are valued highly by the students. When given guidance and opportunity, adolescents seized the chance to integrate visual and verbal forms of expression and to produce their own books. It is hoped that this project report will encourage others to organize similar activities for adolescents that encourage them to combine their visual and verbal communication skills.

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Creative Drama: Indirect Teaching, Affective Domain, and School Reform

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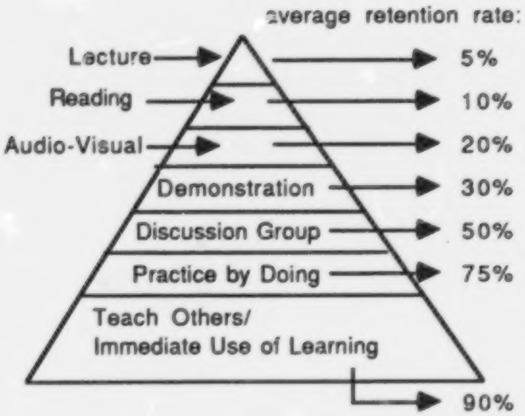
Introduction

"If telling was the same as teaching, we'd all be so smart we could hardly stand it" (Mager, 1968, p. 7). We have all had the experience which Mager is describing. Traditional practices in schools tend to be the teacher standing in front of the students dispensing information in the form of a lecture or other teacher centered method. This happens in spite of a proliferation of research which would indicate that not much learning takes place in this type of a classroom. Generally, our children are being miseducated, not only because of the way they are being taught, but also because of the content of what they are being taught. Our youth are losing their spirit to learn and their spirit to live constructively in society.

Picture the most memorable experiences you had in school. Invariably those experiences are not lectures, unless you were embarrassed or humiliated in some way; they are experiences in which you as a student participated in a much more meaningful way, e.g. projects, writing assignments (remember that senior research paper?), out-of-your-chair activities, athletics, music events or drama. (It would be absurd to try to learn to hit a baseball by listening to a lecture.)

Learning takes place when students are actively engaged in the learning process. Retention is higher. Although this common-sense approach is supported by research, it is not adhered to in many classrooms in America. Unfortunately, we are teaching our children to hate learning because of the ways we teach; we are teaching them to accept without question what we teach; we are not teaching them to ask "why" we are learning this material; we are not asking them to question their values, nor are we asking them to think at higher levels. The learning pyramid which follows demonstrates graphically which media and which methods of teaching enhance student retention. Notice also that the use of visual media rapidly enhances learning. Creative dramatics is one more visual method of learning which enhances retention. It could fit on the pyramid from the "audio-visual" level to the "immediate use of learning" level.



Notice the retention level of those activities which require student involvement.

Educators need to "rethink" the teaching/learning process. Learning is not about what the teacher does, but rather it is about what the student does. If the student is actively engaged in learning activities, it is logical that they will learn more. Teachers need to incorporate indirect methods of teaching in which the teacher becomes the facilitator of learning and the student becomes responsible for his or her own learning. This is not simply done by using indirect methods like cooperative learning, contracts, writing process, discovery learning, simulations, etc., although these methods are a step in the right direction. But we also must start to affect the student's "will to learn," their attitudes about learning, their values, and their motivation.

It does not necessarily follow that by using indirect methods, students will be more motivated to learn. We can't overcome all the negative influences in student's lives, e.g. dysfunctional families, violence, commercialism, television, etc. But by the time the first graders of 1992 graduate from high school, the amount of information in the world will have doubled twice, computers will have gone through at least two new generations of change, and many new inventions will have been discovered. We can no longer assume that we can teach students everything they need to know in order to survive in the world. We must teach them to communicate, to investigate, to think critically, and to use other higher order thinking skills. Educators must try to offer children the opportunity to learn how to learn. And hopefully, we will offer them the opportunity to love learning. Creative drama is one of those indirect methods which can "turn children on" to learning. It will also help students to explore new visual learning methods. If you have ever seen the deaf dancers from Gallaudet University or have ever been moved intellectually or emotionally by theatre, then you know that drama is a wonderful visual learning tool; yet, it incorporates all learning modalities. Visual literacy is not an isolated skill; in the real world, it too is inter-connected with text and auditory literacy

This paper will focus on the theoretical underpinnings of using creative drama in the classroom and describing some generic activities which may inspire teachers to use drama in their classrooms. Teachers should adapt these ideas to their own classes. The whole idea is to improve the sense of community, to allow students to express feelings and values, and to help them retain relevant information with the help of this visual media called creative dramatics.

Play and Schooling

The impulse to play is common to all children and can become a way toward continuous learning, a medium of expression, and eventually an art form. Play and the creative process are perceived as having a close relationship; art may be one aspect of play. (Anyone who has read Kurt Vonnegut or seen a Jackson Pollack painting certainly gets a sense of play from both of these artist's work.) Many teachers reject play on the grounds that it is frivolous and unrelated to serious learning. Other teachers have embraced play as a way to motivate learning, as a way for students to express themselves, and as an art form. Children often give play serious thought and concentration, but often they are made to believe that it is unworthy of school time and not productive nor related to learning. Often the will to play is forever extinguished by teachers, those who should be nurturing and using it to their advantage in the pursuit of knowledge.

Educational objectives do not necessarily exclude play as a tool. The general aims of education today are to enhance the growth of the child as an individual and as a member of society. Goals may vary in different school districts, but generally, we want students to have knowledge, skills and an appreciation of the culture thye live in, including the arts. Most schools try to meet the following objectives:

- Develop basic skills in which reading, writing, arithmetic, science, social studies, and the arts are stressed;
- Develop and maintain good physical and mental health;
- Grow in the ability to think;
- Clarify values and verbalize the student's beliefs and hopes;
- Develop an understanding of beauty, using many media including visuals, words, color, sound, and movement;
- Grow creatively and thus the student experiences his or her own creative powers (McCaslin, 1984).

Obviously, including creative drama in a curriculum will not automatically insure that all these goals will be met, but many goals of creative drama are shared with those goals of general education.

- Creativity
- Critical thinking/thinking skills
- Social growth, empathy, humor
- Cooperative learning
- Improved communication skills
- Clarification of values/attitudes
- Knowledge of self
- Learning to learn
- Understanding one's own physicality, relationship to the space around us
- Retention of content

If there is a significant crossover between the goals of education and the goals of creative drama as demonstrated on the above lists, then perhaps creative drama is a tool we educators can use to enhance learning and motivate students in both the cognitive and affective domains. However, before we discuss some methods for using this tool we should define creative drama and elaborate on what is meant by each of the above goals of creative drama.

What Is Creative Drama?

The Children's Theatre Association of America in 1978 defined creative drama in part:

> ...an improvisational, non-exhibitional, process-centered form of drama in which participants are guided by a leader to imagine, enact, and reflect upon human experiences... The creative drama process is dynamic. The leader guides the group to explore, develop, express and communicate ideas, concepts, and feelings through dramatic enactment. In creative drama the group improvises action and dialogue appropriate to the content it is exploring, using elements of drama to give form and meaning to the experience (Heinig & Stillwell, 1981).

It is important to note that the teacher is called a "leader" and that creative drama is a process which explores content as well as feelings. These ideas of process and facilitator are not new words to those working for school reform. "New schools," it is believed, should hire facilitators, not teachers (the connotations are much different), and should ask students to reflect on the learning process, not memorize facts and regurgitate them at test time.

What kinds of activities are included in creative drama? Creative drama stresses spontaneity and improvisation and may include movement, pantomime, games, improvised story dramatizations, and group improvisations. An activity may be as simple as having students "write" their spelling words with their bodies, or as sophisticated as a group improvisation of the working conditions which children endured in the sweat shops of the Industrial Revolution. Many teachers "try" creative drama once, and label the process not effective based on one failure. It is important to remember that a warm, caring environment must be established before creative drama will work; however, many teachers have found that creative drama can also help to establish a warm, caring environment. Creative drama in the classroom is generally used to promote personal development and cognitive skills, not to develop skilled actors. The environment of the classroom is much more relaxed and cooperative than if students were performing for an audience. Their peers become the audience, but this does not imply criticism. Children do not perform for others outside of the classroom for several reasons. First, the objective of creative drama is to enhance learning, not to create a theatrical production. Second, performance is open to criticism and that does not necessarily enhance self-confidence and a feeling of well being. And finally, it is important for students to understand that learning is not merely a product which we measure on a test or on the performance of a skill or on a finished art product; it is the process which we should continue to develop throughout a lifetime. The goals of creative drama expand as the leader becomes more experienced in the process. Some of these goals are explored in the next section.

Goals of Creative Drama

Using creative drama gives students the potential to develop language and communication skills, problem solving skills, and creativity; to promote a positive self-concept, a social awareness, and empathy; to clarify values and attitudes; to encourage humor; and to assist in the retention of information.

Language and communication skills

When the leader asks the students to improvise a story or role play a situation, the children are enacting language situations which might come up in everyday life--no script exists for these situations. Students are allowed to practice their verbal and nonverbal behaviors without criticism and then they can evaluate their own behavior. An example of this kind of creative drama is to allow students to play the role of their parents and give them a situation laden with conflict. How do they deal with it? This may not make them entirely empathetic toward their parents, but it certainly creates an awareness of what parents go through. These types of situations are improvisational in nature and each activity will vary depending on the students involved. The activity is spontaneous but allows the student to reflect on his or her behavior after the drama activity. Students are actively engaged in exploring their own language skills and ability to communicate.

Problem solving and creativity

Often our schools are guilty of the most deadly sin of all. We don't allow students to think for them-selves. We don't encourage them to ask why. We don't allow them to think critically about what is happening to them in school. Tradition-ally, we tend to spoonfeed them the "right" information so they can get the "right" answer on the test. We don't ask them to make decisions based on their own ability to gather information and evaluate it. When we give students opportunities to try to solve open ended problems in a creative drama activity we are asking them to hypothesize, guess, redefine the problem, even identify the critical elements of the problem. When we ask them to role play and give them a conflict to solve, they must generate their own solutions by discovering many possible alternative solutions, exploring the feasibility of each, and evaluating the effectiveness of each.

Creativity exists in all of us to some degree. It is the authors' contention that many people don't think they are creative because the public schools have driven their creativity into deep hiding. Creativity is a tool for helping us solve some of the most pressing problems we will be facing as we approach the year 2000. Studies have been done which demonstrate that students who are allowed to use creative drama score higher on a variety of creativity tests (Karioth, 1967; Prokes, 1971; Schmidt, et. al., 1975, as reported in Heinig & Stillwell, 1981) including cognitive and visual skills. This evidence would seem to indicate that drama is a powerful tool for nurturing creativity and visual literacy.

Positive self-concept/humor

When we feel good about ourselves we tend to want to explore our world, meet new people, take on new challenges, take risks. By doing this, people become even more self-assured. When using creative drama in the classroom, children learn to be themselves. They are also encouraged to explore and expand their vision of "self." Positive guidance is the key to good self-concept development. The leader must allow all children to succeed; through creative drama success can happen.

Watch children at play and then watch children at school. The behavior is different; the most noticeable difference is absence of laughter. School is serious business; we leave our laughter outside the school doors in the morning. When working with children in a creative drama setting, children are able to laugh, as a group and sometimes they are able to laugh at their own mistakes. Research continues to point out that in order for learning to take place, students must be receptive to learning (Anderson, 1985). Creative drama helps to create joy in the classroom and helps to make students more receptive to learning.

Social awareness/empathy

Through creative drama, students can relive the past, can play roles and make decisions which allow them to walk in another's shoes: be the attorneys at the Scopes trial, be Harry Truman deciding to drop the bomb to end World War II, be in charge of making the decision to invade Iraq. Creative drama allows many varied learning experiences. Students learn to plan together, to enact ideas together, to organize their playing space, to share the spotlight, and to experience a variety of human interactions through the use of cooperation rather than competition. Creative drama can help students learn empathy by encouraging them to step outside themselves and move away from egocentricity. It can encourage the students to look at the world from another point of view and respond as others might, thus becoming less ethnocentric as well.

Clarification of values and attitude

The authors don't intend to tell anyone what to believe, but they feel strongly that it is important for teachers to help students find, test, and refine their own beliefs. All of the decisions we make in our lives are based on our values. In creative drama, students can "try on" other values and see if they "fit." If they don't "fit" then students can discard them without harming family or society's values. Creative drama deals with people in action, facing life, making decisions, and then living with the consequences of those decisions. By recreating a story, for example, the student has to deal with the conflict of the story as the character might and by doing so the student explores his or her own values.

Content/retention of information

Our job as teachers is not to entertain students; we simply can't with television. The objective of creative drama is not to entertain children, although it is extremely entertaining for both students and teachers. Creative drama can help students retain information. Gagne and Briggs (1979) talk about the eight events of instruction. Two of the first three are "gaining student attention" and "calling on prerequisite knowledge." Creative drama can do both. Additionally, by using creative drama, students can make new information more meaningful and thus attach it to existing schema more readily. Creative drama can help us to deliver content in a more exciting way and can help students retain information as well as affect attitudes about certain content. For example, it might behoove a "mathphobic child" to look at math through a creative drama activity like acting out a story problem. We tend to think that the teacher's job is to teach the "best" children in the class; in reality, those children will most likely get the information no matter what our methods. The students we should be teaching are those who have the most difficulty in learning. Creative drama can help us do that. Some other questions which teachers may have will be answered in the following section.

Questions Teachers Often Ask

What is the leader's role? This is an indirect method of teaching which requires the leader to be a facilitator; that does not mean that the leader sets the students free to play. The leader is responsible for designing and organizing the activities. Often inexperienced teachers are not sure they want to direct or plan creative activities because they feel that the children's freedom will be limited. Freedom can be encouraged within the organization of the activity; everyone needs some direction. Additionally, one goal of the leader is to help the children reach some level of self-direction. As the leader becomes more aware of the skills and capabilities of the students, he will let the students carry out more of their own ideas and plans and make more decisions as a group. Until the students have some experience in creative drama, the leader's responsibility is to organize and direct. After the students become more familiar with the process, the leader becomes a resource for guiding the children to make their own discoveries.

The leader must take into consideration the ability of individual members of the group: the requirements of the activity, personality, age, needs, and interests. Pacing is important because of the adverse effects of frustration and, conversely, boredom. One of the most important elements of the process is the personality of the leader. This aspect is often overlooked. The leader should find her or his own "style" of creative drama, e.g. acting along side the students, facilitating ideas from outside the groups of students, storytelling as the students act. The leader should find a way to become comfortable with the process. You don't have to be a professional actor, and in some cases it may be better if you aren't. It is the authors' belief that all teachers can use creative drama, no matter what their personalities are like, but some teachers will be more effective than others. Just as other personality factors such as enthusiasm, warmth, empathy, and caring are demonstrated in wonderful and unique ways, so too is creative drama implemented in the classroom. Don't be afraid of using this tool because of your own perceived lack of creativity. You will continue to grow as your students grow.

What are the elements of a creative dramatics activity? Action is the essential element of drama. Children must push back their desks and be engaged physically. The process of developing creative drama in the classroom requires the students to move freely and creatively with disciplined, sustained, controlled, and thoughtful movement. All children should be able to use their space efficiently and to share it democratically.

Creative drama also is concerned with building children's sensory awareness. The leader will ask the students to expand their knowledge and awareness of environments, both real and fantasy, through the use of senses and imagination. In creative drama, children get the opportunity to play a variety of roles and characters and to experience the feelings and behaviors of these characters. The leader will want the students to understand what motivates behaviors; to interpret feelings and behaviors; to empathize with others; to put themselves in other's shoes; and to discover the common bond of human emotions that transcend time, age, and geographical boundaries. By being involved in such activities, the leader will encourage the students to become less egocentric and less ethnocentric.

In addition to nonverbal/visual behavior (action and sensory awareness), creative drama also encourages verbal interaction. The leader will want the students to play a variety of roles and situations. The key here is to let the students explore their own language, express their own ideas, and, additionally, listen to and appreciate the ideas of others.

Where do the ideas and materials come from? Many teachers are constantly on the lookout for good materials for writing or other content areas which they teach. The use of creative drama is simply a logical extension of this trait. Textbooks, newspapers, literature, personal experiences, visual materials such as films, videos, pictures, etc. are all sources. One wonderful source is the children themselves; encourage them to develop their own activities. Props like old clothing, hats and artifacts are great sources for springboards into creative drama activities.

Does the entire class participate? Frequently the children all work individually without interacting with others, which provides privacy and a minimum amount of distraction from others. This allows for concentration, individual absorption, and the opportunity for students to savor their ideas and their uniqueness.

They can work in pairs and in groups. Here they have the opportunity to engage in important social interaction. They can stimulate each others' thinking, integrate ideas, lend support, and learn to compromise and cooperate. They may solve problems, create together, discuss, and appreciate each others' contributions. Individual efforts become part of the greater whole.

Pairs and groups may play in unison, play in private, or concentrate on their own ideas. Unison playing creates the psychological security necessary for venturing into experimentation and creative work. There is also less chance for hesitancy or show-off behavior. Demonstrating for each other is dealt with in two ways. First, the children share with each other, and second, they observe and appreciate the ideas of others. During this stage self-evaluation is the only evaluation allowed.

Should all children be strongly encourage to participate? Students participate as an observer, a discussant, an analyzer, or a player. His participation will vary according to his interest in the subject, his mood, his confidence, and his awareness of his own needs. Children enjoy playing in creative dramatics when they are secure in the classroom climate and are interested in the activity being played. Forcing a child to participate in creative dramatics doesn't work. Many children prefer to observe first to see if they like the activity and if they think they can do it. They may also be interested in the responses of their classmates and of the leader. Sometimes they also need a model for the kind of behavior that is expected of them. They can imitate until they have confidence in their own thoughts and creative abilities.

Does the leader participate actively in creative dramatics? This decision depends on the leader's personality and style of teaching, but it can vary. Sometimes the topic, the age of the children, and their personalities will be determining factors. The various ways the leader can participate are designed for controlling the playing, enhancing the playing, assisting with dialogue, and helping the children feel more at ease.

How often is creative dramatics used? It will probably depend on how many ways the leader can see relationships between drama and other curricular goals. There are drama possibilities everywhere: in current events, school and home life as well as in specialized subject areas. To elaborate or reinforce concepts in any of these subjects the leader can incorporate pantomime, improvisation, creative story-building, or even extended project work involving the culminating activity of semi-formalized enactment.

How does a teacher incorporate creative dramatics into the curriculum? Creative dramatics need not be considered a special subject area by itself. It incorporates so many skills and should be used in conjunction with any other subject area: language arts, science, social studies, or the fine arts. In social studies, the children may enact the conquests of Pizzaro. In music the children might dramatize the folk song "Frog Went A-Courtin'." In science they may pretend to experience a day in the life of a kang-aroo rat, and they may pretend to be the cheerleading animals in Eve Merriam's poem "Cheers."

Creative drama experiences can involve facts and concepts as well as emphasizing problem solving, evaluation and creative thinking. Children can pretend to be molecules reacting to varying physical cond-itions. They can experience the various facets of work in a logging camp or pretend to be a twenty-first century man solving a problem typical of that time. Creative drama can motivate children to discover new information and skills. For example, children may pretend to dig in old ruins which in turn may motivate them to learn anthropological excavating procedures in order to play the activity with greater accuracy.

Creative drama can also provide a way to check for children's understanding. Before introducing children to a unit on simple machines, the leader may give the children movement experiences in pretending to be machines. As the children play the leader can note what concepts he needs to reinforce and what misconceptions he needs to correct. Learning experiences can be extended or evaluated through creative drama. For example, field trips can be recreated or elaborated. Children can visit a fire department and learn about firefighters, see the equipment they use and the way they live at the station house. Back in the classroom those experiences can be played out, utilizing the information gained.

A classroom teacher may also want to use creative drama as the central activity in an extended project. For example, the teacher may select a story from a specific country the children are studying and integrate music, dance, art, social studies, or science activities into a long-range project. This may include dressing up in native costumes, learning native dances, eating native food, and singing native songs. Some specific examples of ways to use creative drama follow (Bedard, et. al., 1985).

Some Examples of Creative Drama Activities

In order to clarify some of these examples of creative drama activities, the authors would like to share some warm-up activities or icebreakers and some simple activities which may be appropriate for either elementary or secondary students. It is important to remember that these are exercises which they have used, but each individual teacher should develop his or her own activities so that you can "own it" and use it in your own classroom. Adapt the process to your own teaching style and personality.

Warm-up/icebreakers:

Energy Ball--The "shakes" are contagious! All of the students stand in a circle. In the middle of the circle is an imaginary ball of energy. Ask the students to picture what it looks like. The leader starts by asking each of the students to reach in on the count of three and "energize" their hand. She reaches in and grabs some energy from the ball and starts shaking her hand. The students follow suit. The leader calls out other parts of the body and models the passing of the energy to the different parts of the body. Then the students "energize" that part only. Finally, the energy is passed to the head and continues all the way down the body so that each student starts to shake all over. On the count of three everyone "freezes." Debrief: feel the energy, the tingle, what causes that feeling?

Red light/green light or melt/freeze--A student is chosen to be "it." Other students line up and try to move without being caught. The "it" student turns away, turns back at random, says "red light," and the students freeze in place. Any child still moving, must go back to the beginning. This is an old childhood game and there are several variations which can be used in creative drama. One variation is "freeze" and "melt." The teacher has the students moving around the room. She can call out different ways to move or suggest characters or abstract ideas such as acting as wild animals or as a color or as a musical instrument. The teacher calls out "freeze." Students then stay as still as possible, making funny or distorted statues. Another command may be "melt;" the student then pretends to melt in place. The "freeze" command can also be very helpful when the teacher uses it as a classroom management tool. Later, when the teacher wants to get the students to pay attention to another activity, she may simply call out, "freeze."

Content:

The leader can use these activities as tools to teach content or to reinforce facts, concepts or skills.

Body spelling: The students in first grade are learning three letter words. Ask three students to get up and use their bodies to spell a word, e.g. cat, dog, hat, etc. After the first three students spell a word, any of the other children may get up and change the word to spell another word; for example, the original students spell cat, and a new student gets up and replaces the "c" with an "f" to make the word fat. Debrief by asking the students to spell all the words which they created with their bodies.

Math games: A variation of body spelling is to have students solve math problems and use their bodies to depict the number. Another math activity is to give the students little drums or percussion instruments and have them "beat out" addition problems or subtraction problems, e.g. 4 (four beats) plus 7 (seven beats) = 11 (eleven beats). Geometrics is fun for the students. Identify the major shapes found in the room. Students are asked to collaborate and form shapes which are called out by others. You may want to add a time limit. Other variations: cross the room sideways as a group. Make the smallest possible shape with your body. As a group, make the smallest triangle. Stretch up to your biggest height. Create lines, angles and curves. This activity reinforces major math concepts, but, additionally, it asks the students to work cooperatively.

Activities for language arts and social studies: Give the students a nursery rhyme to "act out." Many learning outcomes can be developed from this activity. One activity that works well is to have the "audience" (students) identify the parts of the story, e.g. beginning, middle and end; or conflict, conflict resolution and denouement, etc. A possible social studies activity is to have the students each create a movement and a sound for a "part of a machine." Then have four students combine into one machine. Then have two groups of four combine. Have students continue until they profess exhaustion. Debrief by asking students what it felt like to be a machine. Discuss the kinds of jobs that machines do. In a previous lesson the students discussed child labor during the Industrial Revolution. Discuss what it must have felt like to work at a machine until you were ready to fall over from exhaustion. Discuss the danger involved and how that kind of an environment dehumanized children.

It is important to remember that you as the teacher must be creative--look for ways to incorporate creative drama in your classroom. It is not the only way to teach, but it will certainly help if you are looking for ways to motivate your students and to motivate yourself. It is important to give yourself a chance to fail; it may not work every time in the beginning. Creative drama will help your students with retention, empathy and cooperation toward others, verbal skills and many other goals. Schools need to change. They must change to meet the needs of this quickly changing world. They need to become places which encourage creative activities, critical thinking and other higher order thinking skills. They need to be places where students learn to cooperate rather than compete. Creative drama can be used as a tool to help meet all of these goals. But you, the teacher must be willing to take a chance. Creative drama can be unnerving at times because the children will be allowed more freedom and the leader will not have "iron-fist control," but it can also help bring laughter, joy and the love of learning back into America's classrooms. Let's never forget that teachers don't teach content (math or science or history), they teach children.

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The Use of Verbo-Visual Information in Teaching of Geography -- Views from Teachers

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This study is a direct follow-up of our previous study (Metallinos et. al. 1990) on geography textbooks in Australia, Greece, Japan, Sweden and the USA. While the previous study focused on the *representations*, this study focuses on the teachers (*the senders*) and their *actual use* of media and pictures in their teaching of geography in secondary schools in our five countries. For this study we have formulated the following four questions:

- What *kind of media/equipments* are geography teachers using in their teaching of geography?
- What *kind of pictures* are geography teachers using in their teaching of geography?
- What is the *purpose* of using pictures in the teaching of geography?
- Are there some *cultural differences* in the use of media and visual support in the teaching of geography?

Methodology

To get some basic information we developed a questionnaire (enclosed), translated it to our respective languages and send it to secondary school geography teachers. Teachers were asked to answer the questionnaires and return them to a given address. Teachers did not have to sign the forms with their names. The three assignments were:

- *Medium*. In my teaching I use to utilize the following kinds of media/equipments.
- *Picture type*. In my teaching I use to utilize the following kinds of pictures.
- *Purpose*. In my teaching I use to use pictures for the following aims and reasons.

For "Medium" and "Picture type" the teachers could choose between five different alternatives: (1) At least once every lesson, (2) At least once every week, (3) At least once every month, (4) At least once every semester, and (5) Never.

To be able to compare the use of each medium (or picture type) we have ranked the use of media (picture type) and calculated an *index of utilization* (Pettersson, 1991). This index is calculated in the following way. The frequency of use is multiplied by 0 for "Never" by 1 for "At least once every semester", by 2 for "At least once every month", by 4 for "At least once every week" and by 8 for "At least once every lesson". These values are added and the sums divided by 8. If the teachers never utilize a specific medium the index of utilization is 0. If all the teachers in a sample utilize a medium every lesson the index

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of utilization is 100. An index-value of 50 means that the medium, on average, is used every week. An index-value of 25 means that the medium, on average, is used every month. An index-value of 12.5 means that the medium, on average, is used every semester.

By adding the index-values for all media it is possibly to compare the "total utilization" of media. The same procedure is applied to picture types. If all teachers in a sample utilize all the different media during every lesson then the "total utilization" is 1700. If no teacher utilize any medium at all during the whole semester, then the value of the "total utilization" is 0. For "total utilization" of pictures the corresponding figures are 900 and 0 respectively.

For "Purpose" the teachers were free to write whatever they liked. These comments were noted and summarized for each country.

Data

For each country the answers from the individual teachers were registered on a form. All teachers did not answer all the assignments. For this reason we calculated the frequence of answers for each variable and then calculated an index of media utilization (table 1) and an index of picture utilization (table 2). The comments on purpose of use of pictures are presented as a listing (table 3).

Table 1. Answers from geography teachers for the assignment "In my teaching I use to utilize the following kinds of media/equipments" (%), calculated index of media utilization and the total utilization of media. (n = number of teachers).

Australia

	at least once every				never	n	index
MEDIUM	lesson	week	month	semester			
black board	67	33	0	0	0	24	83
flip chart	0	0	10	10	81	21	4
textbooks in geography	25	50	17	8	0	24	55
school-atlases	17	67	17	0	0	24	54
other books	17	35	43	4	0	23	46
wall-maps	18	27	23	23	9	22	40
papers and journals	17	50	17	8	8	24	47
wall charts	0	19	38	19	24	21	21
film strips	0	9	0	27	64	22	8
slides	0	11	63	5	21	19	22
OH-transparencies	22	43	26	9	0	23	51
OH-maps	17	0	39	43	0	23	33
film/s	9	17	26	30	17	23	28
(educational) TV	0	10	30	30	30	20	16
video	0	25	46	29	0	24	28
computer software	0	0	14	36	50	22	8
other	0	8	0	0	92	24	4
Total							548

Greece

		at least once every			never	n	index
MEDIUM	lesson	week	month	semester			
black board	40	0	0	0	60	43	40
flip chart *							
textbooks in geography	100	0	0	0	0	43	100
school-atlases	35	16	5	0	44	43	44
other books	26	28	2	0	44	43	40
wall-maps	21	9	0	0	70	43	26
papers and journals	7	5	0	0	88	43	9
wall charts	7	7	2	0	84	43	11
film strips	0	0	16	7	77	43	5
slides	0	7	14	0	79	43	7
OH-transparencies	5	0	0	0	95	43	5
OH-maps*							
film/s	0	2	14	7	77	43	6
(educational) TV	0	0	0	0	100	43	0
video	0	2	7	0	91	43	3
computer software	0	0	0	0	100	43	0
other	0	0	0	0	100	43	0
Total							296

* Flip chart and OH-maps were misinterpreted by the teachers

Japan

		at least once every			never	n	index
MEDIUM	lesson	week	month	semester			
black board	100	0	0	0	0	63	100
flip chart	0	6	17	28	49	47	11
textbooks in geography	98	2	0	0	0	62	99
school-atlases	97	3	0	0	0	63	99
other books	49	23	11	0	18	57	63
wall-maps	65	19	6	3	6	63	76
papers and journals	15	18	35	23	10	62	36
wall charts	22	22	20	18	18	60	40
film strips	0	0	5	0	95	55	1
slides	0	0	15	29	56	55	7
OH-transparencies	14	20	19	20	27	59	31
OH-maps	10	22	12	20	36	59	27
film/s	0	0	5	16	79	56	3
(educational) TV	2	10	14	29	45	58	14
video	2	18	30	22	28	60	21
computer software	0	0	2	0	98	58	1
other	8	0	0	0	92	26	8
Total							637

Sweden

		at least once every			never	n	index
MEDIUM	lesson	week	month	semester			
black board	85	15	0	0	0	40	93
flip chart	0	8	10	5	78	40	7
textbooks in geography	75	25	0	0	0	40	88
school-atlases	33	41	13	3	10	39	57
other books	30	38	28	0	5	40	56
wall-maps	15	55	18	13	0	40	48
papers and journals	3	30	45	15	8	40	31
wall charts	0	5	5	15	74	39	6
film strips	0	15	40	25	20	40	21
slides	0	28	43	23	8	40	27
OH-transparencies	8	25	35	23	10	40	32
OH-maps	0	28	18	30	25	40	22
film/s	0	5	45	33	18	40	18
(educational) TV	0	3	18	33	46	39	10
video	0	3	53	30	15	40	18
computer software	0	0	10	10	80	40	4
other	0	0	0	0	100	40	0
Total							538

USA

		at least once every			never	n*	index
MEDIUM	lesson	week	month	semester			
black board	25	63	0	13	0	8	58
flip chart	13	13	0	13	63	8	20
textbooks in geography	13	38	0	13	38	8	33
school-atlases	0	38	25	25	13	8	28
other books	43	29	29	0	0	7	64
wall-maps	13	75	13	0	0	8	53
papers and journals	13	25	38	13	13	8	36
wall charts	0	25	13	38	25	8	20
film strips	0	13	38	38	13	8	20
slides	0	13	0	0	88	8	6
OH-transparencies	38	0	38	13	13	8	48
OH-maps	13	13	0	0	75	8	19
film/s	13	25	38	13	13	8	36
(educational) TV	0	13	25	50	13	8	19
video	0	13	63	0	25	8	2
computer software	0	25	0	38	38	8	17
other	0	0	100	0	0	1	25
Total							525

* Please note that the number of teachers in this sample is rather low which may influence the quality of the index values

Table 2. Answers from geography teachers for the assignment "In my teaching I use to utilize the following kinds of pictures." (%), calculated index of picture utilization and the total utilization of pictures. (n = number of teachers).

Australia

	at least once every				never	n	index
PICTURE TYPE	lesson	week	month	semester			
words, tables and formulas	33	17	33	8	8	24	51
diagrams and graphs	25	50	25	0	0	24	56
line drawings	0	21	71	8	0	24	29
realistic drawings in color	9	14	50	9	18	22	30
B/W photographs	0	35	26	17	22	23	26
color photographs	5	41	45	9	0	22	38
maps	17	83	0	0	0	24	58
"moving" images	0	19	29	19	33	21	19
other	0	0	0	0	100	24	0
Total							307

Greece

	at least once every				never	n	index
PICTURE TYPE	lesson	week	month	semester			
words, tables and formulas	7	0	0	0	93	43	7
diagrams and graphs	7	26	9	0	58	43	22
line drawings	2	19	2	7	70	43	13
realistic drawings in color	0	0	0	0	100	43	0
B/W photographs	9	7	0	0	84	43	13
color photographs	12	35	7	0	47	43	31
maps	53	47	0	0	0	43	77
"moving" images	0	0	0	0	100	43	0
other	0	0	0	0	100	43	0
Total							163

Japan

	at least once every				never	n	index
PICTURE TYPE	lesson	week	month	semester			
words, tables and formulas	43	9	7	4	37	54	50
diagrams and graphs	43	21	11	2	23	56	57
line drawings	19	6	2	9	64	53	24
realistic drawings in color	9	9	15	4	64	55	18
B/W photographs	21	21	18	9	30	56	34
color photographs	27	34	17	5	17	59	49
maps	60	17	10	3	10	60	69
"moving" images	4	14	27	29	27	56	21
other	0	0	0	0	100	0	0
Total							322

Sweden

	at least once every				never	n	index
PICTURE TYPE	lesson	week	month	semester			
words, tables and formulas	53	26	16	5	0	38	70
diagrams and graphs	13	33	30	23	3	40	39
line drawings	10	23	30	8	30	40	30
realistic drawings in color	3	14	22	27	35	37	18
B/W photographs	11	11	22	36	19	36	27
color photographs	13	15	43	18	13	40	33
maps	33	31	21	15	0	39	56
"moving" images	0	19	49	22	11	37	24
other	0	0	0	0	100	40	0
Total							297

USA

	at least once every				never	n*	index
PICTURE TYPE	lesson	week	month	semester			
words, tables and formulas	13	75	13	0	0	8	53
diagrams and graphs	13	50	38	0	0	8	47
line drawings	0	25	38	25	13	8	25
realistic drawings in color	0	63	13	13	13	8	36
B/W photographs	14	14	43	0	29	7	32
color photographs	13	13	50	25	0	8	34
maps	29	43	14	14	0	7	55
"moving" images	0	0	38	38	25	8	14
other	0	0	0	0	100	8	0
Total							296

* Please note that the number of teachers in this sample is rather low which may influence the quality of the index values

Table 3. Answers from geography teachers for the assignment "In my teaching I use to use pictures for the following aims and reasons":

Australia

Answers from 14 teachers (58%): a picture is worth a thousand words, actuality, authencity, better understanding (2), difficult comply with form, for stimulus, originality, real world examples of concepts, reality, students learn more visually than verbally, arouse interest for reality, cater for visual learners, emphasize, enhance the written word-stimulus for work be treated in class, explain, gain greater comprehension of material, give relevance concepts developed, hold attention, improve learning, increase comprehension, provide illustrations, provide visual reinforcements, variety, visual comprehension

Greece

Answers from 27 teachers (63%): a picture is worth a thousand words, stimulate the students to pay closer attention to the teacher's presentation, enrich the teacher's presentation, vivify and enhance the classroom presentation, arouse the student's interest and curiosity about the subject matter, pictures help to break the monotony of the teacher's presentation, pictures provide more knowledge on the subject discussed, and pictures speak louder than words.

Japan

Answers from 33 teachers (52%): for factual realization to get realistic understanding and knowledge (13), to attract interest of students (9), to make images of the area (9), for introduction to new topics, to motivate students, to let students concentrate to the topic, for presentation of common basis for learning, to identify problems to be solved, "seeing is believing", for summarizing the topic.

Sweden

Answers from 19 teachers (63%): authencity, for illustration, for introduction of new areas (2), it is not possible just to read geography, some concepts may not be explained without pictures, to arouse curiosity (2), to arouse interest, to create perspectives, to demonstrate relationships, to demonstrate similarities, to demonstrate, to emphasize (2), to explain difficult concepts, to explain, to illustrate complex information, to improve learning, to increase clarity, to increase comprehension, to minimize abstract matters, to provide illustrations, to show environments, to show places, to show relationships, to supply background information.

USA

Answers from 8 teachers (60%): comment learning to real life, help develop background, help students visualize setting, illustrate a point, introduce a new region, make an event or person or place "real" to students, to give students another way of seeing things, to help students visualize and retain information pertaining to US history and Iowa history, to provide visual stimulus for students, and to spark interest

Discussion

First of all we can note that there is a substantial difference between different individual teachers. Some teachers like to utilize media in their teaching, some do not. Obviously a geography lesson may be carried out in many different ways, depending largely upon the individual "style" of the particular teacher. And if we seek the answer to the simple question: "How do teachers come to choose and utilize certain styles in their teaching?, then it would seem that there are several factors which affect that choice. Among these factors are: 1) their own experience of being taught, 2) the impact of their professional training and, 3) the influence of their professional peer group.

In regard to the first of these factors, it seems that teachers, and especially young teachers, tend to follow the teaching patterns and styles by which they themselves have been taught. They utilize methods which were used by their own teachers either in their secondary school classes or in their tertiary studies. This is the so-called "copy-cat" style, which is also found in other areas of human behaviour.

In regard to the second factor – the impact of teacher training – there is little doubt that this training experience contributes significantly to a teacher´s later teaching style. Those of us who have been involved in teacher education – in the guiding and moulding of professional development – whether in initial training or in subsequent refresher in–service activities – would hope that, indeed expect that, this training is one of the major sources of ideas, inspiration and patterns of teaching style, even though we may sometimes hear from teachers about the inadequacy of their student training, especially in relation to the practical class-room value of it. However, if students have been exposed to many visual media during their professional development, then it appears more likely that they will utilize these media in their own subsequent teaching.

The third factor – peer influence – can be significant in determining teaching style and the utilization of educational media. This influence operates in a variety of ways: through incidental learning from one´s professional colleagues, perhaps in informal staff-room discussions; through formal structured learning experiences such as in-service refresher courses or continuing education seminars and workshops; or through professional associations, such as social science teachers´ meetings or geography teachers´ associations, where they have opportunities to learn about the methods, styles and experiences of other teachers. Hence, if one´s peers or the professional peer groups with whom one associates do use media in their teaching, then one is more likely to do likewise, by a sort of pedagogic osmosis.

As mentioned before the index of utilization is 0 if the teachers never utilize a specific medium. If all the teachers in a sample utilize a medium every lesson the index of utilization is 100. An index-value of 50 means that the medium, on average, is used every week. An index-value of 25 means that the medium, on average, is used every month. An index-value of 12.5 means that the medium, on average, is used every semester. If all teachers in a sample utilize all the different media during every lesson then the "total utilization" is 1700. If no teacher utilize any medium at all during the whole semester, then the value of the "total utilization" is 0.

As we can see from the data above (table 1) and the indexes of media utilization ranked according to the mean values (table 4) many media are seldom used. The *black board* and *textbooks in geography* have the highest rank order. Teachers in Australia, Japan and Sweden use black boards a lot, far more than teachers in Greece and the US. However, the number of teachers in the USA sample is rather small which may influence the quality of the USA index–values. Textbooks in geography are heavily utilized by teachers in Greece, Japan and Sweden. In these countries textbooks are used every, or almost every lesson. In Australia textbooks are used every week. In the USA the teachers, at least in this sample, prefer *"other books"* before the actual textbooks, which are used less than every week.

School-atlases are used every lesson in Japan but only on a weekly basis in Australia, Greece and Sweden. In the USA school-atlases are used about once a month. The utilization of *other books* is rather concentrated around the week. *Wall maps* are most used in Japan, probably on a "every-day-level". In Australia, Sweden and the USA wall maps are used every week, and in Greece every month. *OH-transparencies* are used every week in Australia and the US, every month in Japan and Sweden and every semester in Greece. *Papers and journals* are used every week in Australia, every month in Japan, Sweden and the US, and every semester in Greece.

Table 4. Index of media utilization, ranked according to mean values.

			Country			
MEDIUM	Australia	Greece	Japan	Sweden	USA	m
black board	83	40	100	93	58	75
textbooks in geography	55	100	99	88	33	75
school-atlases	54	44	99	57	28	56
other books	46	40	63	56	64	54
wall-maps	40	26	76	48	53	49
OH-transparencies	51	5	31	32	48	33
papers and journals	47	9	36	31	36	32
OH-maps	33	–	27	22	19	25
wall charts	21	11	40	6	20	20
film/s	28	6	3	18	36	18
video	28	3	21	18	2	14
slides	22	7	7	27	6	14
(educational) TV	16	0	14	10	19	12
film strips	8	5	1	21	20	11
flip chart	4	–	11	7	20	11
computer software	8	0	1	4	17	6
other	4	0	8	0	25	6
Total	548	296	637	538	504	505*

* Calculated on the country totals. The means for each medium are approximations.

All the other media, OH-maps, wall-charts, films, video, slides, educational TV, film strips, flip charts and computer software are all used once every month or once every semester. The total media utilization is on about the same low level in Australia, Sweden and the USA, which is considerably more than Greece and less than Japan.

The indexes of media utilization of flip charts and computer software are very low in Australia. The indexes of media utilization of OH-transparencies, films, video, slides, educational TV, film strips, flip-charts and computer software are very low in Greece. The indexes of media utilization of films, slides, film strips, and computer software are very low in Japan. The indexes of media utilization of wall charts, flip charts and computer software are very low in Sweden. The indexes of media utilization of video and slides are very low in the US.

In all countries graphical media or print media are much more used than AV-media. This difference is obvious if we group the media (table 5). The use of printed media is especially important in Greece where the use of print media is 13 times the use of OH-transparencies, OH-maps, slides, and film strips ("AV-media, stills"), and Japan where this ratio is six times. Australian teachers are the most frequent users of AV-media, they use AV-media 7 times more than the teachers in Greece.

Table 5. Index of media utilization for groups of media.

			Country			
MEDIUM	Australia	Greece	Japan	Sweden	USA	m
Hand made drawings[1]	87	40	111	100	78	83
Print media[2]	263	230	413	286	234	285
AV-media, stills[3]	114	17	66	102	93	78
AV-media, "moving images"[4]	72	9	38	46	57	44
Other[5]	12	0	9	4	42	13
Total	548	296	637	538	525	508

1, black board and flip chart; 2, textbooks in geography, school-atlases, other books, wall-maps, papers and journals, and wall charts; 3, OH-transparencies, OH-maps, slides, and film strips; 4, film/s, video, and (educational) TV; and 5, computer software, and other

In Japan, where so many new information technological equipments have been invented and produced for the world market, teachers are not more interested in new media than teachers in the other countries. One explanation to this is the basic interest to teach what the students need to know of fragmented knowledge to be able to pass the entrance examinations to higher education.

As with media we can note that there is a substantial difference between different individual teachers use of pictures. Some teachers like to utilize pictures in their teaching, some do not.

If all teachers in a sample utilize all the different pictures during every lesson then the "total utilization" is 900. If no teacher utilize any pictures at all during the whole semester, then the value of the "total utilization" is 0. As we can see below (table 6) *maps* are obviously used to a large extent by geography teachers. Maps are used at least every week. The teachers in Greece probably use maps on a "daily basis". Pictures with *words, tables and formulas* are used every week in all countries except Greece. Here this type of visual is used at least once every semester. It is almost the same with *diagrams and graphs*.

Color photographs are used every week in Japan but less often in the other countries. On a lower level the same pattern is true for the *B/W photographs* and the *line drawings*. On average these types are used every month. *Realistic drawings in color* are used every month in all countries except Greece, where they are not used at all. Is is the same pattern, on a lower level, for *"moving images"*. The total picture utilization is on about the same low level in Australia, Japan, Sweden and the US, which is considerably more than Greece.

Table 6. Index of picture type utilization, ranked according to mean values

			Country			
PICTURE TYPE	Australia	Greece	Japan	Sweden	USA	m
maps	58	77	69	56	55	63
words, tables and formulas	51	7	50	70	53	46
diagrams and graphs	56	22	57	39	47	44
color photographs	38	31	49	33	34	37
B/W photographs	26	13	34	27	32	26
line drawings	29	13	24	30	25	24
realistic drawings in color	30	0	18	18	36	20
"moving" images	19	0	21	24	14	16
other	0	0	0	0	0	0
Total	307	163	322	297	296	277*

* Calculated on the country totals. The means for each medium are approximations.

From table 3 (See Data) it is clear that teachers have many different purposes of using pictures in the teaching of geography. For factual realization to get realistic understanding and knowledge (13), to attract interest of students (9), and to make images of the area (9) were the most common purposes.

This study shows that there are clearly different teaching "styles" in different cultures. So, too, it seems there are different "fashions" in teaching practice and these fashions can also differ from culture to culture, and can change over time within different cultures. Fashion in the use of educational media is partly related to the technology that is *available* in that specific culture at that time. A quite simple example of this is the emergence of the felt-pen which led to a greater utilization of flip charts and of transparencies for overhead projection. Also, in recent times in some schools, videos have replaced films in classrooms; in past times, the film strip (even with the limitations of the fixed-sequence presentation which is inherent in it) was widely used, then it was largely superseded by slides (either commercially produced sets of slides on specific topics or personally assembled collections by teachers), but among the teachers surveyed in Australia, Japan and USA in this project, there is currently much less use of slides and greater use of overhead transparencies. As in most cases of changing fashion in teaching, the change or innovation which is adopted is based on sound educational principles, usually supported by research findings which indicate that the new practice will provide for more effective learning. Thus, the more widespread use of projected overhead transparencies came as a rational development, for they do provide for step-by-step learning and for logical sequential presentation and development of concepts, as additional information can be added to or superimposed upon the transparency progressively. Similarly, in some States of Australia, it has become part of current fashion (and indeed almost thereby embedded in the accepted tradition) not to use a single standard textbook for a subject such as geography, in each school form, but rather to use class sets of several textbooks, so as to give pupils wider exposure to different approaches and presentations in the various textbooks, thereby providing them with a greater variety of learning opportunities and experiences.

Regardless of the rapid development of technology during the past years only the black board, printed books and maps are popular media in the classrooms. We can conclude that in all countries teaching still is very much an *oral activity* with very little media support. The possibilities offered by new information technology is not yet utilized. The results from this study suggests that the use (or non-use) of media in classrooms should be discussed and further studied. Is it really important to use media in the classrooms? If the answer is yes we should ask ourselves what we can do to increase the use of media?

References

Metallinos, N., Muffoletto, R., Pettersson, R., Shaw, J. and Takakuwa, Y. (1990). *The use of Verbo-visual Information in Textbooks – a cross-cultural experience*. Paper presented at the International Visual Literacy Association Symposium 1990. Verbo-Visual Literacy. Mapping the Field. July 10-13. University of London, Institute of Education.

Pettersson, R. (1991). Användning av bilder i undervisning. (Use of pictures in education). *Forskning om utbildning. Tidskrift för analys och debatt.* In press.

Use of pictures in the teaching of geography
– views from teachers

This study of the use of pictures in the teaching of geography in secondary schools is carried out among teachers in Australia, Greece, Japan, Sweden and the USA. Please answer the following questions and then return this form to (x) . You don't have to sign with your name. Thank you very much for your help.

(x = the individual researchers)

Gender. I am female male **Age.**_______

Medium. In my teaching I use to utilize the following kinds of media/equipments

	at least once every				
Medium	lesson	week	month	semester	never
black board					
flip chart					
textbooks in geography					
school-atlases					
other books					
wall-maps					
papers and journals					
wall charts					
film strips					
slides					
OH-transparencies					
OH-maps					
film/s					
(educational)TV					
video					
computer software					
other:					

Picture type. In my teaching I use to utilize the following kinds of pictures.

	at least once every				
Picture type	lesson	week	month	semester	never
words, tables and formulas					
diagrams and graphs					
line drawings					
realistic drawings in color					
B/W photographs					
color photographs					
maps					
"moving" images					
other:					

Purpose. In my teaching I use to use pictures for the following aims and reasons:

Teaching Visual Literacy: Questions and Concerns about Curricula

Rhonda S. Robinson

Designing and developing any new course for university programs requires one to examine several areas. Obviously, the topic and content must be reviewed and focused, and the definition, scope and depth of the content considered. The audience must be analyzed to determine their background and their needs and goals relative to the topic. And the needs of the program must be addressed, to allow the course design to integrate into the program at large. In designing and developing my course, Visual Literacy, for the Instructional Technology Program at Northern Illinois University, these three areas were considered.

The topic visual literacy is very large and encompasses a great deal. In order to focus the topic for this class, I concentrated on the definition of visual literacy and on organizing a course which would help adults develop their own visual literacy abilities. The definition from which we work includes the encoding and the decoding of visual messages or communication, but the course concentrates more on the decoding aspects. The definition we use is a combination of many existing definitions; in fact, we have a discussion about eight different definitions and select those with which we are most comfortable. The class then proceeds with the assigned activities understanding what it is they are developing and practicing throughout the semester.

The definition I worked with to design the class was the following.

> Visual literacy is the ability to process the elements of and to interpret visual messages; the ability to understand and appreciate the content and purpose of any image, as well as its structural and aesthetic composition. A visually literate person can perceive, understand, and interpret visual messages, and can actively analyze and evaluate the visual communications they observe. (Robinson, R.S., 1984, 267-275)

The class members usually appreciate this definition, but would prefer one which includes more of the encoding aspects as well. The assignments developed for the class include some production of visual communication, but the course does not teach visual production skills nor does it assume proficiency in those skills for successful completion of assignments.

Using the definition as a means to focus the course, the activities and reading are planned to provide experiences which expand students' abilities. The assignments are progressive, adding new language and more complex characteristics of visuals as we proceed through the semester. The course is basically a survey of the aspects of visual and media literacy; units on reading images, photography, film, video, computer graphics, visual thinking, critical viewing skills, and research in visual literacy follow the definition development. As a survey, the course can provide an overview of these and other areas, and provide ideas for further reading for those interested in a particular area. All students gain an understanding of what the definition is, develop their own skills, and focus on an area of their own interest for some more detailed reading and research.

The students in the program vary widely in their backgrounds and abilities in visual communications. The course is open to new master's and doctoral students, and has only a basic instructional technology course as a prerequisite. Accordingly, the abilities of the students must be taken into account when evaluating the assignments. Students are all adults, most are part-time students who commute to school after work, and many are planning to be either classroom teachers or instructional designers when completing the program.

With a wide variety of undergraduate degrees, the students give a new meaning to the word diversity. We use this to our advantage by having a great deal of discussion and oral presentation in the course. Students learn from one another, and develop their visual skills by practicing, listening and working with others in the class.

The program in Instructional Technology allows for this emphasis on group learning and on development of skills in a non-threatening environment. The course is an elective chosen by those interested as a way to advance their abilities to design excellent instruction for any age group. The program includes courses in instructional design and development of both print and mediated instruction, courses in the design and development of computer-based materials, and an emphasis on international issues, technology and the future, and instructional technology research, especially looking at new and emerging areas of technology and research design. Because of our broad scope, the survey aspects of the Visual Literacy course are appropriate, and the variety of activities we engage are well received by the students. The flexibility of the assignments allows students to draw upon their own backgrounds and interests to focus their work.

The overall philosophy that brings these three aspects together in the course is my own approach to visual literacy. I espouse the development of visual literacy as an essential and integral set of skills and abilities for all adults. I believe that these abilities integrate with our own approach to learning and teaching, and that the development of visual literacy actually changes the way a person thinks, responds to their environment, teaches and learns. Because of this essential ability, we know the world in a different way. Visual literacy is vital, then, to our development, and I present it as an integral part not just of our instructional program, but of life-long learning and development.

The syllabus shows that the experiences and reading built into the requirements of the course help develop these abilities with this philosophy in mind. Each student is encouraged to challenge themselves to advance their skills and new ways of thinking.

Through these experiences, students are encouraged if not required to develop their own visual literacy, to determine its importance to them in their profession and their personal lives, and to practice the encoding of information into visual messages meant to share their learning with classmates. Through these activities, the development of visual literacy is advanced. Students end the course with an exit "test" that helps them assess their own growth. In discussing this test, we often learn that students were not sure of themselves and of their own ability, but that by the end of the course, they have achieved the objectives of the class and have come to believe as I do that visual literacy is an essential part of their lives.

The syllabus is attached for your review. Any further questions, comments or suggestions would be appreciated, as this course changes and grows with each offering. It is only through feedback and dialog that we continue to grow, so your additions would be appreciated.

References

Robinson, R. S. (1991). Visual Literacy Across the Curriculum. *Investigating Visual Literacy* (Eds.) Beauchamp, D. and Braden, R. Conway, AR: International Visual Literacy Association.

Robinson, R. S. (1984). Learning to See: Developing Visual Literacy Through Film. *Top of the News*, 40, 3, pp. 267-275, Spring.

N.I.U. Dept. of L.E.P.S.
LEIT 531: Visual Literacy
"Learning to See"

Fall 1991
Dr. Rhonda S. Robinson
Gabel Hall 219A
(815) 753-0464 Office hours: M & W 2-4 by appointment
(815) 753-9323 and other times by appointment

Required Text:

Beauchamp, Baca, Braden (1991). Investigating Visual Literacy, I.V.L.A., Bloomington, Illinois.
Braden, Beauchamp, Baca (1990). Perceptions of Visual Literacy, I.V.L.A., Conway, Arkansas.
Braden, Beauchamp, Baca (1989). About Visuals: Research, Teaching, and Applications, I.V.L.A., Blacksburg, Virginia.
Readings (see last page) as assigned (copies available for student purchase; on reserve in the Learning Center, Gabel 08).

Recommended Text:

Willows, D.M. and Houghton, H.A. (1987). Psychology of illustration, Vol. I, Vol. II, Springer-Verlag, New York.

Course Goals:

The course will familiarize students with:

- the aesthetic elements of still and motion visuals;
- various theoretical approaches to the study and interpretation of visual media;
- overt and subliminal messages embedded in images in a variety of media formats; and
- the instruction of critical viewing skills to various audiences.

Course Objectives:

The course familiarizes students with visual media, both still and moving images, and helps students develop the ability to critically analyze and interpret media messages. Students will:

- review the concept of visual literacy;
- understand visual imagery;
- analyze visual communications;

- identify design and production elements in visuals;
- appreciate the aesthetic elements of film and television and the language they use;
- review visual learning research and apply it to specific projects;
- critically analyze and interpret the impact of mass media messages, especially the societal impact of film and television.
- consider the development of critical viewing skills

Readings (copies available)

Alesandrini, Kathryn L. (1987). Computer Graphics in Learning and Instruction. Chapter 6 in Houghton and Willows, eds.. The Psychology of Illustration: Instructional Issues. New York: Springer-Verlag; pp. 159-186.

Dondis, Donis A. (1973). A Primer of Visual Literacy, The M.I.T. Press, Chaps. 1 & 2 (pp. 1-38).

Edmonds, Robert. (1982). The sights and sounds of cinema and television. Teachers College Press, Chaps. 1 & 2 (skim), Chap. 21 (read).

Fleming, Malcom (1987). Designing pictorial/verbal instruction: some speculative extensions from research to practice. Chapter 5 in Houghton and Willows, eds. The Psychology of Illustration: Instructional Issues. New York: Springer-Verlag; pp. 136-157.

Griffin, R. E. and Whiteside, J. Alan. (1984). Visual literacy: A model for understanding the discipline, in Walker, Braden, and Dunker (eds.). Visual Literacy-Enhancing Human Potential. Bloomington, IN: International Visual Literacy Association, pp. 70-82.

Jacobs, Mark; and Kohrda, Ken (1981). Photography in Focus. Skokie, IL: National Textbook Company. Chapter 8: Visual Aspects of Photography.

Levie, W. Howard. Research and theory on pictures. JVVL, 4,2 (bibliog.).

Monoco, James (1981). How to read a film. Oxford Univ. Press, Chaps 1&3 (skim).

Robinson, Rhonda (1986). Television literacy for adults: Learning to see TV. Media and Adult Learning, 9,1, pp. 13-16.

Course Outline

Session	Date	TOPICS	ASSIGNMENT DUE (see refs.below)
1	8/26	Course Overview	
2	9/2	No Class (Labor Day)	
3	9/9	Visual Literacy: Definition	Symbol due (#1) Dondis reading
4	9/16	Decoding Visual Images	Bring a fav. photo Jacobs & Kokrda readings
5	9/23	Photography	Griffin & Whiteside reading
6	9/30	Critique Presentation	#2
7	10/7	Computer graphics	Alesandrini reading
	10/9 to 10 13	IVLA Conference, Washington D.C.	
8	10/14	Research: Discussion/presentation	#3
9	10/21	Research: Continued	
10	10/28	Film-Genres, symbolism	Monoco reading
11	11/4	Television Analysis-form and substance	Edmonds readings
12	11/11	Visual thinking exercises	
13	11/18	Video critique	#4
14	11/25	Teaching Critical Viewing	Robinson reading
15	12/2	Class Presentations: Papers or Visual Productions	#5
16	12/9	EXAM WEEK: Class as necessary for presentations	

Course Assignments

As evidence of the successful completion of this course, the student will:

15% 1. Participate in class assigned readings and discussions and develop a personal visual symbol.

15% 2. Select one graphic, print advertisement, photo, or poster and utilize visual design criteria to discuss and critique the visual presentation. Design elements include: composition, color, texture, line, shape, frame, contrast, and pattern. Written critique, 1-2 pages, presented in class. (Computer generated graphics may require additional elements.)

20% 3. Review three related articles from I.V.L.A. Conference Reading or one-two chapters from the Psychology of Illustration, Vol. 1 or 2.

3.1. Summarize the articles in a written review (approximately 5 pages). Discuss, including examples of ways the information could be translated to the design or conceptual framework of a project (script, production, text, course, outline, etc.)

3.2. Exemplify and visualize your presentation.

20% 4. Using a format discussed in class, critique a film or videotape segment (and commercial or a short segment of a film rated G, PG, or R). Choose 1-2 elements from the definitions of visual literacy presented in class to focus your review (3 pages). Copy your segment and bring to class if possible (VHS).

30% 5. Select A or B and C

A. Select and area of interest related to visual literacy, visual communication or critical viewing skills and research further. Develop a paper or instructional unit on this topic. Present a summary or an activity from this assignment in class

B. Select an aspect of the visual vocabulary and visual design discussed this semester and explore it through photography, film, television production or computer program design. Produce and exhibit to class your photography (print or slides), animation, videotape, or computer program. Present your written plan and description of this project to the instructor by October 31.

C. Exemplify and visualize your selection to the class. This will be your opportunity to illustrate your use of visuals for presentation and instruction.

Visual Literacy: A Course for Educators

Landra L. Rezabek

"*Visual literacy* is the learned ability to *interpret* visual messages accurately and to *create* such messages. Thus, interpretation and creation in visual literacy may be said to parallel reading and writing in print literacy" (Heinich, Molenda, & Russell, 1989, pp. 70-71). This definition reflects the perspective that visual literacy is an area of study in which particular skills, knowledge, and attitudes can be taught and learned which enhance one's ability to communicate in a variety of visual forms. Contrary to the misconceptions of some, being visually literate does not necessarily require one to be a gifted painter, sculptor, film maker, or *artist* at all. Artists, obviously, have well developed visual communication skills, but extraordinary talent is not a prerequisite for being visually literate. Visual literacy more importantly requires an interest in developing one's communication skills using visual means. And since visual literacy is a process requiring the ability to both *send* and *receive* messages effectively in order to participate in two-way communication, visually literate persons need to develop a variety of proficiencies.

The idea that visual literacy is an area of study in which the basics can be mastered through thought, practice, and continued interest is the philosophy around which a course taught at the University of Wyoming has been developed over the past three years. Though not limited to graduate students in education, the course, *An Introduction to Visual Literacy*, is designed for educators interested in extending their knowledge of the field of visual literacy and applying this new awareness in their educational environments. Students who have enrolled in the course include elementary and secondary classroom teachers representing all age levels and subject areas. In addition to classroom teachers, school administrators, library media specialists, special education teachers, and school counselors also have enrolled in the course, along with a few students from the College of Arts and Sciences and the College of Commerce and Industry. A common concern of those electing the course is the desire to develop their visual literacy abilities in order to become more effective educators in their particular environments, and this concern is reflected in the design of the course.

An Introduction to Visual Literacy offers students opportunities to develop their knowledge concerning both theoretical foundations and accepted practice in the field, their skills in utilizing the tools of visual communication, and their attitudes concerning the topic. As can be seen in the attached sample syllabus, the course includes a wide variety of topics primarily selected for their educational implications. Students are cautioned that the course is merely an overview of the many intriguing topics associated with the study of visual literacy and are warned that many equally viable topics are omitted due to time constraints. Students are challenged to study some of these additional areas of interest or to dig deeper into some of the topics presented as they prepare a class presentation. These presentations take the form of instructional units designed by each student to further the visual literacy of a specific audience with which the student intends to work. In this way, students: 1) deepen their knowledge, skills, and attitudes concerning visual literacy in a specific area of interest, 2) share their expertise with other class members, and 3) develop an instructional unit which they believe will help them meet a legitimate instructional need and further the visual literacy of their own students.

Before designing and presenting the instructional units, class members participate in a variety of assignments designed to engage them in *doing visual literacy* in addition to learning *about* the topic. The following example describes the initial class assignment which serves to integrate knowledge, skills, and affective outcomes during an introductory lesson. Graduate students, many of whom have had little experience with visual expression since sixth grade art class, often find the thought of communicating without the written or spoken word quite intimidating. To help students begin to *think, feel, and do visual literacy*, the initial class assignment is for students to assemble a visual collage which represents who they are — past, present and/or future. Students may not use letters or words to communicate their messages, but just about anything else visual is acceptable. Students engage in this activity without having completed any formal instruction on the topic, but the assignment is graded satisfactory or unsatisfactory to lessen anxiety. Students are told to include visual information about themselves that they will not mind sharing with other class members. It is also quite important that the instructor participates in this activity by creating a collage as well.

When students return with their collages, the works are displayed simultaneously and students silently view the gallery of projects. Projects often include three dimensional collages that incorporate tactile objects and realia as well as traditional two-dimensional cut-and-paste posters. After viewing, class members have a chance to tell the creator of each collage what the visuals indicate about the person who made the collage. Each creator must remain silent during the comments, but after the verbal feedback, each creator has an opportunity to clarify any misperceptions. Misperceptions do occur; for example, class members believed that a picture of bronze baby shoes meant that someone had a child or children when the creator meant them to represent a happy childhood. But misperceptions lead naturally to a discussion of communication models and processes and to the issues of visual language and syntax. The collages also provide good student-produced examples of many of the principles of visual design and communication such as the use of line, color, and balance. When students' natural ability to send and receive visual messages is reinforced at the beginning of the course and when students use their visual communication skills to help establish a class bond, a sense of mutual trust among students and the instructor sets the tone of the course where students are encouraged to explore and develop their interests in the field of visual literacy.

Persons interested in discussing other aspects of this course or issues associated with teaching visual literacy are encouraged to contact Landra L. Rezabek, 307 Stone Building, B-197, Department of Educational Research, Florida State University, Tallahassee, FL 32306-3030, (904) 644-4592, BITNet: Rezabek@FSU, INTERNET: Rezabek@fsu1.cc.fsu.edu.

Reference

Heinich, R., Molenda, M., & Russell, J. D. (1989). *Instructional media and the new technologies of instruction* (3rd ed.). New York: Macmillan.

INTRODUCTION TO VISUAL LITERACY
ITEC 742, Fall 1990
Thursday, 4:00 - 7:00 p.m.

Instructor: Landra L. Rezabek
Office: Education Building, Room 303
Address: College of Education, Box 3374
University of Wyoming
Laramie, Wyoming 82071
Phone: (307) 766-3608
(307) 766-2167 (messages)
Office Hours: Monday - Thursday, 3:00-4:00 p.m.
And by Appointment

Catalog Description:

Visual Literacy refers to a group of vision-competencies a human being can develop by seeing and at the same time integrating with other sensory experiences (John L. Debes, *The Loom of Visual Literacy*). This course is concerned with techniques of developing these competencies and methods by which such developments can be encouraged in others.

Course Goals

Students will investigate several of the many areas of study associated with the term "visual literacy". Students will apply principles and concepts of visual literacy in the design and production of an instructional unit which furthers the visual literacy of a selected target audience.

Specific Objectives

Upon completion of this course you, the student, will be able to:

1. Provide a definition of the term "visual literacy".
2. Analyze visual messages, following principles discussed in class.
3. Design and produce effective visual messages, following principles discussed in class.
4. Discuss orally and in writing several of the "strands" of the visual literacy movement and associated principles and research.
5. Apply principles of visual literacy in the design, production, and presentation of an instructional unit which furthers the visual literacy of a selected target audience.

Required Texts

Dondis, D. A. (1973). A primer of visual literacy. Cambridge, MA: MIT Press.

Fleming, M., and Levie, W. H. (1978). Instructional Message Design. Englewood Cliffs, NJ: Educational Technology Publications.

Self-selected readings from the Proceedings of the International Visual Literacy Association and/or other sources.

Required Materials

Access to "disposable" magazines.
Access to a camera, print film (24 prints), and Ectachrome slide film (± 24 slides)
Water-soluable (erasable) marker.
Eleven or twelve sheets of acetate/clear plastic/report covers.
"School supplies": glue, scissors, construction paper, poster board, paints, crayons, etc.

Course Requirements

Complete all readings and participate in class discussions and activities. (S/U)

Assemble a collage in which you visually represent "who you are". (S/U)

Assemble a portfolio of visuals which illustrates selected principles from the Dondis text according to specified requirements. (20 possible points)

Complete the visual composition assignment according to specified requirements. (10 possible points)

Complete the visual sequencing assignments according to specified requirements. (10 possible points)

Complete the photo essay assignment according to specified requirements. (10 possible points)

Complete Fleming and Levie Projects #1-#4 according to specified requirements. (40 possible points)

Submit brief summaries of seven self-selected readings. (S/U)

Submit a brief summary of Visual Education. (S/U)

Write five potential test questions, two of which must involve visual cues or visual responses. (S/U)

Complete the test (final exam). (60 possible points)

Applying principles of visual literacy, design and produce an instructional unit which furthers the visual literacy of a selected target audience. Units will be presented during class presentations of approximately 20 minutes each. An annotated bibliography of at least three sources on visual literacy other than assigned readings will be distributed by each student. (Project: 100 possible points.)

Grading

Points earned in the course will result in letter grades of:

A	(95% and above)	237 - 250 possible points and NO "U's"
B	(85% and above)	212 - 236 possible points and NO "U's"
C	(75% and above)	187 - 211 possible points and NO "U's"
D	(65% and above)	162 - 186 possible points
F	(below 65%)	fewer than 162 points

Points will be earned by completion of the following:

Dondis portfolio	20 possible points
Visual Composition	10 possible points
Visual sequencing	10 possible points
Photo essay	10 possible points
Fleming & Levie projects	40 possible points
Test	60 possible points
Class presentation	100 possible points
Total	250 possible points

IMPORTANT: To earn letter grades of A, B, or C, students must NOT receive a "U" on any of the S/U assignments. If a "U" is received on any assignment, the letter grade as earned by percentage points will be lowered one letter. Students may re-submit projects which received a U, but must be aware that class participation will not be able to be "made-up" or re-submitted.

NOTE: Regardless of cumulative points, all class projects, tests, and activities must be completed for class credit to be received. All work must be completed and submitted for grading no later than 7:00 p.m., Thursday, December 13, 1990.

Calendar

Session 1: September 6

Introduction to the course
Review of communication theory
Visuals in communication

Assignment: Assemble a collage in which you visually represent "who you are," due September 13 in class.
Complete Reading/Summary #1

Session 2: September 13

Why Man Creates (film)
Collages
Basic elements of visual communication
"Visual Elements in Art" (slide/tape)
Discuss Reading/Summary #1

Assignment: Read Dondis, Preface through Chapter 6, Chapter 8 (pp. 146-150 and 171-182), and Chapter 9.
Begin work on Dondis portfolio, due Sept. 27.
Complete Reading/Summary #2

Session 3: September 20

Basic elements of visual communication, continued.
Discuss Reading/Summary #2

Assignment: Continue reading Dondis
Complete work on Dondis portfolio, due September 27.
Complete Reading/Summary #3

Session 4: September 27

Discuss Dondis.
Analyze/discuss Dondis portfolios.
Discuss Reading/Summary #3
Brainstorm possible projects

Assignment: Complete Reading/Summary #4
Read Arrow to the Sun (Gerald McDermott) before class on Oct. 4.
Begin reading Fleming & Levie at your convenience
Prepare one paragraph synopsis of your proposed class presentation.

Session 5: October 4

Visual language
Visual conventions
Visual composition
Visual sequence
Arrow to the Sun (film and book)
Discuss Reading/Summary #4
Brainstorm class presentations.

Assignment: Work on visual composition assignment, visual sequencing assignment, and photo essay assignment, due October 25.
Read/skim Visual Education, due October 11.
Read/skim Brody and Dwyer readings, due Oct. 11.

Session 6: October 11

Visual Education (video)
Discuss visuals in education and instruction
Discuss visuals in society (?)
Discuss questions/procedures for "IVLA Live" teleconference.
Discuss Fleming and Levie projects

Assignment: Prepare for "IVLA Live" teleconference.
Continue reading Fleming and Levie and begin thinking about Fleming and Levie Projects.

Session 7: October 18

"IVLA Live" -- conference call with convention participants in Normal, Illinois. Class will meet Thursday, October 18, 3:30-4:30 p.m. in Wyo Hall, Room 319.

Assignment: Complete Reading/Summary #5
Finish reading Fleming & Levie in time to complete projects by November 8.
Prepare refined one-paragraph statement of your proposed class presentation.

Session 8: October 25

IVLA Update
Analyze/discuss visual composition, visual sequencing, and photo essay assignments.
Discuss Fleming & Levie preliminary readings and projects.
Discuss Reading/Summary #5
Brainstorm class presentations.

Assignment: Read/prepare for Dr. Chatton's lecture, as advised.
Fleming and Levie readings and projects due Nov. 8.

Session 9: November 1

Visual literacy for young people -- Dr. Barbara Chatton

Assignment: Fleming & Levie readings and projects due November 8.
Complete Reading/Summary #6
Begin writing five test questions, due November 15.

Session 10: November 8

Review visuals for young people
Discuss Fleming & Levie (Visuals for instruction continued)
Analyze/discuss Fleming & Levie projects
Discuss Reading/Summary #6

Assignment: Complete Reading/Summary #7
Write five test questions, due November 15.
Read Carol & Francis Dwyer and Levie articles, due November 15.

Session 11: November 15

Research in visual literacy
The future of visual literacy
Exchange test questions.
Discuss Reading/Summary #7
Presentation consultation and troubleshooting

Assignment: Prepare for class presentations.

Session 12: November 29

Class presentations and discussion.

Assignment: Review for test (final exam)

Session 13: December 6

Class presentations and discussion

Assignment: Review for test (final exam)

Session 14: December 13

Class presentations and discussion
Review for test (final exam)

Assignment: Prepare for test (final exam)

Final Exam: December 20 or as scheduled by registrar

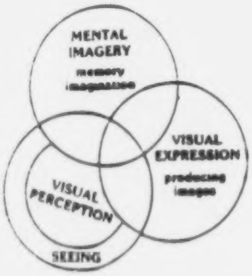
To See or Not to See -- That Is the Question

Barbara Fredette

The USES OF VISUAL IMAGERY IN THINKING AND LEARNING is the lengthy title given to a course that has been developed in the Humanities Education Program at the University of Pittsburgh. The focus of this course is on the multiple meanings that are ascribed to visual images, imagery and imagination within an educational context. During the course participants explore theory and practice in several areas designated by the term VISUAL which includes VISUAL thinking, VISUAL learning, VISUAL communication and especially VISUAL literacy. Included in the course is an active examination of the ways we create and use "pictures in our minds" as well as those which are external.

By the end of the course participants are expected to improve skills in visual thinking and communication, increase interest in visual literacy and learning and apply course content to their own area of expertise. Students with varied backgrounds are attracted to the course but Inservice Teachers and Instructional Design Specialists are in the majority.

The content for the course is organized with reference to the graphic representation given below. It may be seen as both an operational model (suggesting the way in which images are selected or created) and a morphological model. It is used as the latter to organize course content sequence. In addition Constructivist Psychology grounds the design and selection of the learning activities connected to each of the components of the graphic form. This acknowledges that participants must construct their own knowledge. To do so they must be given opportunities for personalized elaboration of the content and it is through mediated and open-ended activities and exercises that this occurs.



a graphic representation of the interactive processes of
VISUAL THINKING

Many exercises and activities are involved. For example to introduce the component SEEING we begin with a set of slides organized around the theme "Let there be LIGHT". The physics and function of light are encountered through the slides. The marvelous evolution and function of the eye is considered and discussed. Manilla folders which have photographs or painting reproductions taped inside with openings cut in the cover so that only eyes can be seen are used in the discussion. This leads to an activity with materials.

For most of the participants realistic representation is the dominant visual experience therefore an activity with found images is designed to encourage an imaginative approach to seeing. In "the recontextualized eye" students are asked to look through image sources (magazines, newspapers) to find an eye or eyes that attract their attention. Then they are to find another image in which they can place the eyes so that a visual statement about what it means to see is made. These are exhibited and discussed. Reference is made to the surrealists who juxtaposed images--Magritte's painting "Mirror of the World" is re-viewed.

The next topic is PERCEPTION where the question "SEEING IS...THINKING?" is the focus for reading and activity. In this manner the graphic form continues to provide for sequence in the course.

Readings from the texts are also organized by the topics identified through the graphic. In addition extensive periodical readings address related contemporary issues. The texts are by McKim and Dondis. In addition two projects are required. One is a written report in which the participants are expected to demonstrate an understanding of visual abilities by presenting a rationale and plan for the development of visual abilities in a population of interest to them. The second is a visual project in which they are expected to give evidence of the ability to analyze visual needs and to design and develop a visually mediated approach to facilitate skill or knowledge acquisition in a selected area of endeavor.

This is a very brief overview of the course. Anyone who is interested in a more complete syllabus or in sharing some ideas of their own may contact Barbara Fredette, Humanities Education Program, 4C21 Forbes Quad, University of Pittsburgh, Pittsburgh, PA 15221. (412) 648-7316.

Reaction to "Teaching Visual Literacy: Questions and Concerns About Curricula"

Barbara Seels

Presentations on courses about visual literacy were made by Nikos Metallinos from Concordia University, Robert Muffoletto from the University of Northern Iowa, Barbara Fredette from the University of Pittsburgh, Forrest Wisely from Illinois State University, Landra Rezabak from Florida State University and Rhonda Robinson from Northern Illinois University. Even though many differences were highlighted, there were core similarities among the courses.

The first similarity is that each course presents a continuum that represents the visual literacy or learning process. The points on the continuum and the terminology used may differ, but instructors in visual literacy courses make students attend to a process that starts with perception or ideation and ends with decoding or expression; in other words, one that starts with mental imagery and ends with shared meaning. Some of the terms used to describe this continuum were encoding to decoding, perception to coding to composition and information to application.

A second area of similarity is philosophy. While the philosophical basis differed, all the courses were oriented primarily around a philosophical rather than a psychological position. This philosophical orientation seems to be determined to a large extent by the institutional context and the instructor's interests. Some of the courses had an orientation towards a constructivist point of view; while others were post-modern, critical, or pragmatic in orientation.

In addition to philosophy, the differences between courses showed mainly in the areas of scholarly base, readings and activities. The scholarship used as a theoretical base ranged from social and political criticism to communications theory to psychological experimentation. There were also obvious differences due to philosophical orientation that affected the proportion of time devoted to topics. Instructors used a variety of assignments, exercises, readings and activities. There was little consistency in choice of textbooks. Textbooks used included:

-- Heinich, Molenda & Russell. *Instructional Media* and *The New Technologies of Instruction*

-- Willows & Houghton. *The Psychology of Illustration*

-- IVLA Proceedings of recent conventions

-- Dondis. *A Primer of Visual Literacy*

-- Fleming & Levie. *Instructional Message Design*

-- Berger. *Ways of Seeing*

-- Berger. *Media Analysis Techniques*

- Goffman. *Media Advertisements*
- Nichols. *Ideology and Image*
- McKim. *Experiences in Visual Thinking*

Deborah Curtiss' excellent text, *A Primer of Visual Literacy* wasn't mentioned.

Another major difference was in the scope of the course in relation to the topic of visual literacy. Some instructors focused on the value of imagery, images and imagination. Others included visual thinking and visual communication techniques. Critically interpreting mass media was one common focus. Aesthetics was addressed in all the courses; although in some cases it was related to pictures and in others to film. In general, the courses all had a broad focus, perhaps too broad. It may be time to move towards a sequence of courses instead of one course that fulfills all functions.

If the panel's presentations are considered as a group, several issues are raised. The first issue is that the problem of defining visual literacy continues to plague this area. The second issue is that there is little agreement on the purposes for teaching visual literacy, and there should be. The third issue is that instructors are making decisions about what to include and exclude in a course based on their own rationale, not any rationale provided by the study of visual literacy. A fourth issue is how to integrate instructional and aesthetic principles.

If visual literacy is being able to read and write visual language and being able to think with and about visual language, there is a long way to go before instructors are prepared to develop these skills in a general college population or even graduate school.

Technical Graphics as a Catalyst for Developing Visual Literacy Within General Education

Gary R. Bertoline
Terry L. Burton
Scott E. Wiley

I. Introduction

It is common knowledge that Alexander Graham Bell invented the telephone. There is also common belief that the discovery of his magnificently simple inspiration was the result of specialized study within a specific discipline. So thought most people in Bell's day too. "Put all your eggs in the one basket," wrote Mark Twain (1910), "and - watch that basket." We might therefore suppose that Bell proceeded on the one-basket plan. Fortunately he did not. If he had, he would never have invented the telephone.

His invention depended on knowledge that had been available for nearly half a century. Why had no one thought of it before Bell? Many an expert on electricity has asked himself that question. Physicist James Clerk Maxwell (1877) had an answer. "I consider the telephone," said Maxwell, "as a material symbol of the widely separated departments of human knowledge, the cultivation of which has led, by as many converging paths, to the invention of this instrument by Professor Graham Bell." The electrical experts had put all their eggs in one basket and watched only that basket. Committed to the telegraph, they could not stand back far enough to see the promise of a radically different approach to communication. Even if they had seen it, their electrical expertise would have suggested more technical barriers than openings.

It is generally recognized that the implementation of the computer in graphic training is providing a tremendous knowledge realm from which educators can create graphic experiences for students. It is an undeniable influence that is proving unique as an educational instruction opportunity. Computers and the application of computer graphics are providing the delivery environment for teaching visualization theory and thus developing students' visual literacy abilities.

Based on this ever-growing body of knowledge relating to graphic education, there appear to be many educators who use the one basket theory. These individuals feel the way to correct student visual literacy problems is to focus concentrated study of graphics within their discipline. An example of this is Scientific Visualization.

Unlike Math and Science, Technical Graphics is advocating the establishment of a separate discipline that deals with all forms of graphics, the *Graphic Sciences*. The promotion of this educational area is intended to extend beyond the current levels of higher education to encompass all of education. The goal is to graphically educate all students and provide them with knowledge and skills relating to graphics that are deemed necessary to participate in society. It is proposed that educators stand back and look at this new graphic potential for expanding their educational arena.

II. Reconceptualizing

It has become clearer in recent decades that each of us lives in the world which we have personally constructed within ourselves (Glasser, 1981). This indicates that we set up expectations about the way things work within our memories, and that this conditions our responses to what IS. If we imagine ourselves to be in a mechanistic world, then our world becomes that of causes and effects, much like the machines in the workspace. If we believe ourselves to be isolated beings, then we will lead unconnected lives amidst a stream of others. If we believe we are all interconnected then we relate to and with those around us.

Believing this to be true, the defining and developing of a base rationale for formal graphic training that concerns our waking conscious from which to focus holistic educational pursuits within the area of graphics is of primary importance. This reconceptualizing tends to concern itself with the internal and existential experience of the world. It also attempts to understand the nature of reality, relate it to the educational experience and finally focus on the realm of formal graphics training (Figure 1).

Education, including Technical Graphics education, is a living system of experiences which interact to facilitate learning and development. This belief, in itself, is a classic example of holism. The holistic paradigm seeks to eliminate conceptual divisions between education and other dimensions

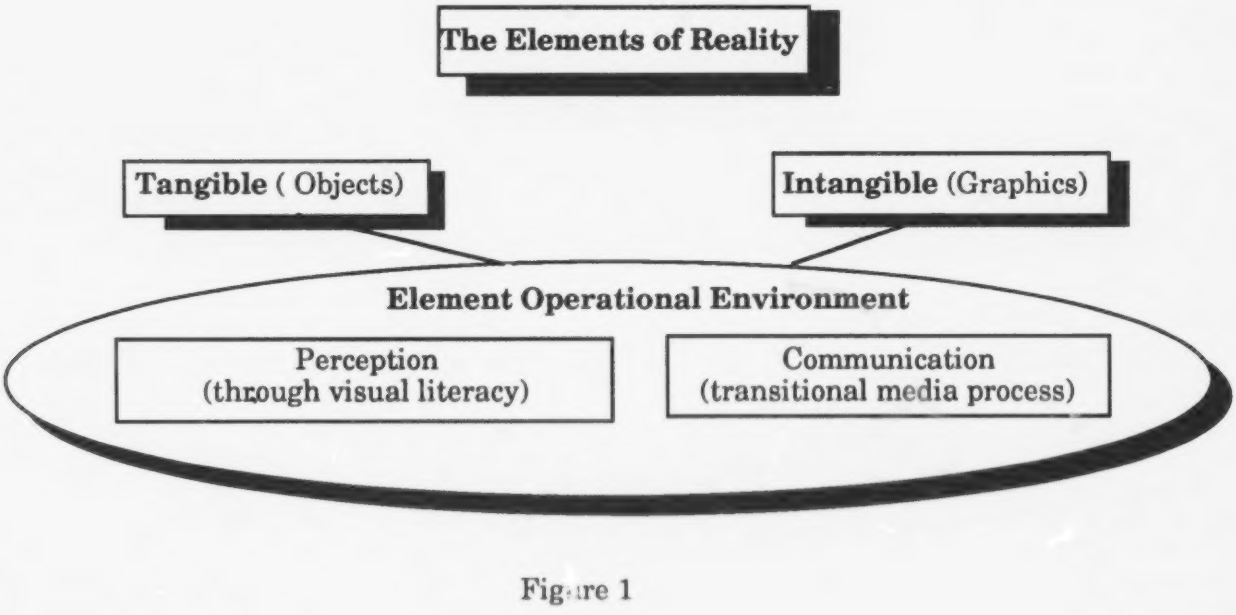


Figure 1

of the world which affect the student, and within the domain of education itself. Zigler (1978) indicates that while various approaches should be encouraged in examining educational phenomena, the holistic paradigm sees the various approaches as integral parts of a more inclusive whole or system. Earlier, John Dewey (1930) emphasized that inquiry should terminate in a "unified whole." This means that there is a vital need for the integration of the specialized findings of different disciplines. In fact, all areas of human knowledge are seen to be interdependent and interconnected. This central and distinctive assumption of the holistic paradigm is clearly related to some of the early work in Gestault methodology. This is to say that features or laws defining a whole system are not entirely derivable from the study of its parts. Thus, the assumptions and research findings associated with other educational paradigms are considered to be parts of a larger, more unified system or whole. The upshot of this contention is that it is important that educators not only conclude the curriculum with a unified holistic or capstone approach, but as Dewey also suggested, (educators) should begin with a "vague" or tacit whole (1933). This method has been described by Maslow (1970).

> Starting with a vague grasped whole, we analyze its structure into subdivisions, parts, etc. Through this analysis we discover difficulties with our original conception of the whole. The whole is then reorganized, redefined, and rephrased more exactly and more efficiently, and is as before subjected to analysis. Again this analysis makes possible a better, more precise whole, and so on.

The "larger picture" of developing an operational base on which to integrate formal graphics training into all educational disciplines becomes a personal goal. Formal graphics education is being recognized as being at least as important to the development of the whole student as other educational pursuits. As is evidenced by other disciplines curricula development efforts, graphics is becoming a cornerstone on which to develop perception of many of their theories.

Many respected education professionals have and are advocating the necessity of whole brain development in education. It seems logical, since graphics deals with whole-brained thought processes, left-brained analysis and right brained cognition, that formal graphics training be a part of all educational systems. This reconceptualizing of graphics will hopefully provide avenues of integration into many disciplines.

III. Graphics as a Science

In the text, *Graphic Science* (1963), T. E. French and C. J. Vierck said, "Every basic science consists of a terminology and/or a language, coupled with theories, proofs, facts and applications. Compared with most other sciences, graphics differs only in that the language is somewhat more extensive and complex. Other aspects are similar." The question then becomes, if graphics is a science, worthy of influencing many disciplines, where are the theories they mentioned? Certainly, projection, size or shape description and other theories are important to teach. Yet these specific theories, extremely relevant to technical and engineering graphics education, have not had their importance recognized or integrated into other disciplines. Why?

Why haven't Technical and Engineering Graphics been able to develop a broader application within education? Maybe that was the original intent of Engineering Graphics professionals, but the realization of graphics as general education and a science has not occurred.

Possibly, Technical and Engineering Graphics educators have continued to put their eggs in one basket. They have lost sight of more global obligations to education in developing the whole student. This tunnel vision may have resulted in concentrating on a few relative theories and practices that become too specific to be relevant beyond the immediate area. Short-term gratification of educational goals ignores the needs of students beyond just drawing. Maybe this is why Technical and Engineering Graphics has not developed into French and Vierk's vision of becoming a science.

In an article titled, "Graphic Science - A New and Challenging Frontier." A. S. Levens (1955) advocated the importance of recognizing and developing engineering graphics as part of the broader educational entity Graphic Science.

Recently, several prominent Engineering Graphics educators have proposed that the graphic body of knowledge be developed into a new definition of the discipline as Graphic Science (Bertoline, et al., 1990). They have defined graphic science as "...the knowledge and study of the theory and techniques, psychomotor and cognitive foundations, and applications for all types of drawings. It is the theory and technique used to create real or imagined drawings and models. Graphic Science is the foundation for all types of drawings and is the basis of the subject matter for all related curricula."

Evidence is mounting that indeed graphics is a science and should be developed as such. Technical Graphics, as a subset of Graphics Science, when applied in a pedagogically sound curriculum, can provide a broad range of graphic experiences that can lead to achieving a predetermined level of graphic competency necessary in many disciplines. It uses accepted standards as the basis on which to construct formal graphic instruction. The time to seek relevant theory in support of it and thus help install formal graphic training as a part of all educational environments is at hand.

IV. Technical Graphics

Before discussing the primary goals of Technical Graphics, it may be necessary to provide the reader with a new perception of the field. The name "Technical Graphics" projects an ordinary next door neighbor feeling that may cause some to assume an acquaintance with it that may no longer be true. In the past Technical Graphics has been taken to mean engineering drawing, mechanical drafting computer assisted design (CAD), or architectural illustration. But new technologies have altered the parameters of Technical Graphics so much that it can now be called the "familiar stranger" of visual disciplines.

The assumed familiarity and the controlled, technological, industrially flavored sound of the name has caused some to look upon it as a limited subclass of other fields such as fine arts, industrial design, or engineering. To them, Technical Graphics may not yet have been recognized as a separate field. But to professionals in Technical Graphics today, this view is inaccurate and reveals a need to promote an awareness of the field, for it has come of age as a legitimate self-standing discipline. As partial evidence, the Board of Higher Education of the State of Indiana recently approved the first bachelor's degree program in Technical Graphics effective Fall of 1991. It is offered through the Department of Technical Graphics in the School of Technology at Purdue University.

Technical Graphics has been redefined as "the graphical communication of technical information." As such, it includes the design, presentation, and publication of graphics, technical artwork, and technical documentation, generated by freehand, mechanical, and computer processes (Wiley, 1989a). Technical Graphics is a broad visual discipline; a visual communication discipline that aids in the design, documentation, and marketing of technical information. It relates strongly to a number of already recognized fields (Figure 2) and is heavily influenced by emerging computer graphics technology. Due to these considerations the development of visual literacy is a constant, primary goal of Technical Graphics education.

Those who teach Technical Graphics are responsible for preparing competent practitioners of technical graphics

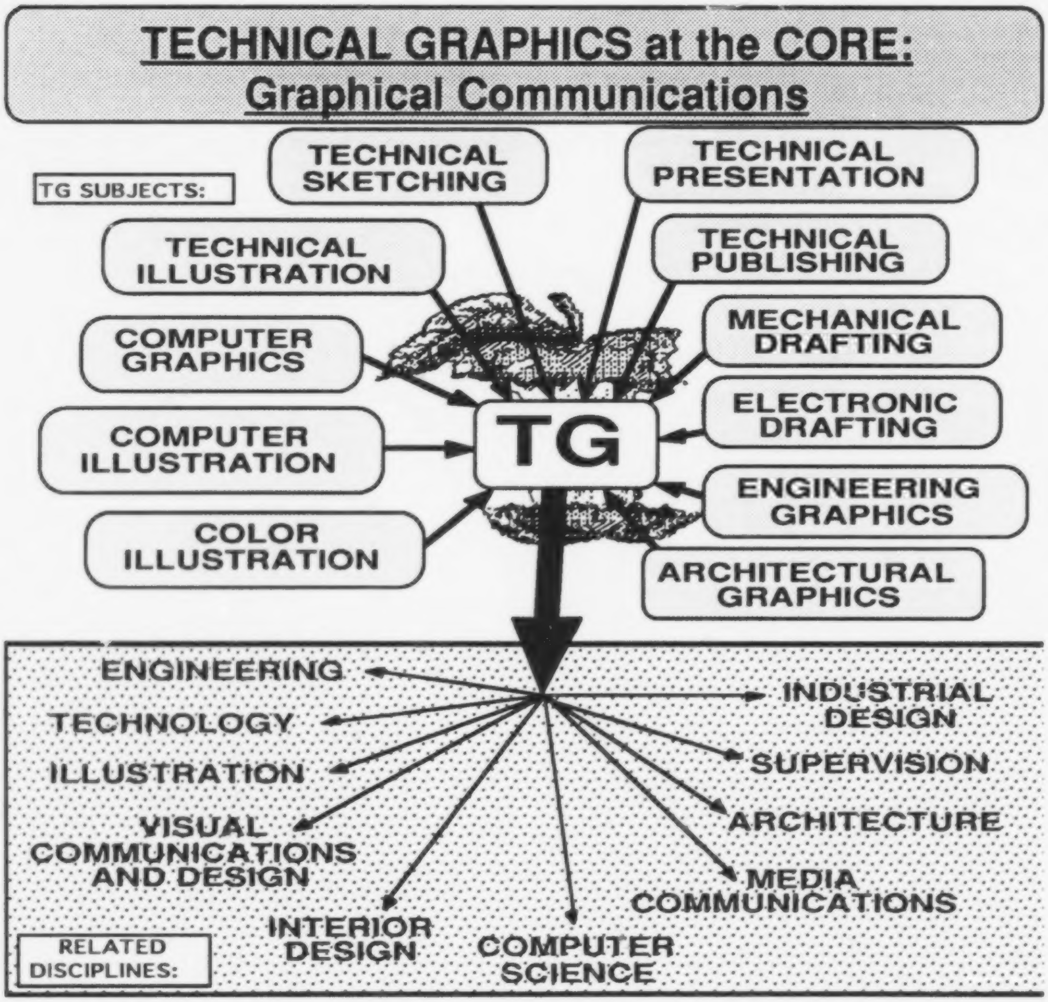

TECHNICAL GRAPHICS at the CORE:
Graphical Communications
TG SUBJECTS:
TECHNICAL SKETCHING
TECHNICAL PRESENTATION
TECHNICAL ILLUSTRATION
TECHNICAL PUBLISHING
COMPUTER GRAPHICS
MECHANICAL DRAFTING
COMPUTER ILLUSTRATION
TG
ELECTRONIC DRAFTING
COLOR ILLUSTRATION
ENGINEERING GRAPHICS
ARCHITECTURAL GRAPHICS
ENGINEERING
INDUSTRIAL DESIGN
TECHNOLOGY
ILLUSTRATION
SUPERVISION
VISUAL COMMUNICATIONS AND DESIGN
ARCHITECTURE
MEDIA COMMUNICATIONS
INTERIOR DESIGN
COMPUTER SCIENCE
RELATED DISCIPLINES:

Figure 2

for business, industry, education, and other domains. Students in Technical Graphics are guided through a curriculum that increases freehand, mechanical, and computer skills which lead to the effective communication of technical information in widely diverse fields. As examples, course projects may require the development of color illustrations for communicating product features, mechanical drafting to display architectural information, or computer illustrations to portray anatomical data about the human body. Technical graphicians may work with engineers, industrial designers, computer technicians, advertisers, scientific and medical personnel, interior designers, architects, and many others to facilitate the communication of technical information through graphics that combines images and text.

As in other visual disciplines, the development of visual literacy is important in Technical Graphics for two primary reasons: to increase the ability to produce visual products that communicate effectively, and to increase the ability of others to clearly understand them. These considerations can mean anything from mastering surface rendering techniques in prismacolor, to correct interpretation of technical information on engineering drawings, to the design of geometric models for use in high end computer animations.

Every area of Technical Graphics necessitates intimate knowledge of visual production and communication. Visual elements and principles must be controlled whether the graphical product is on paper or disk, uses traditional or computer processes, or combines text with images. Lines, forms, colors, contrast, positive and negative space, light, and many other components must be manipulated to enhance communication. Technical graphicians are visual producers who must be able to control and understand the complexities of visual products at all phases of a design sequence so that communication is as clear as possible. An underlying goal is to enable visual consumers to understand what has been produced. Due to the emphasis on technical communication through such diverse media, the technical graphician has a great need to be visually literate in many kinds of media.

V. The Primary Goals of Technical Graphics

Technical Graphics has its deepest roots in engineering graphics and descriptive geometry. But it also has strong ties with other visual disciplines and diversified fields such as publishing. At its heart is an orientation toward the design and manipulation of geometric modeling, especially within the computer environment. It is a broad, visually rich field that challenges students as they pass through complex learning experiences that bring them into contact with a wide variety of techniques and processes.

Visual literacy is actively taught in all phases of Technical Graphics. As students pass through stages of visual learning they grow in visual perception and visual memory abilities which in turn increase their internal visualization skills. Growth in visualization enables them to externalize their ideas more competently during the entire design process. As they progress, they learn to continually edit their projects to improve communication. In the production atmosphere of a lab class they receive valuable feedback from others about how well their projects communicate intended goals. The design process is terminated when these goals have been reached. Figure 3 illustrates the three primary stages of the visual learning sequence under discussion: visual cognition, visual production, and visual resolve. As shown elsewhere (Wiley, 1990a,b), these stages are not unique to Technical Graphics but are based on psychological constructs related to many visual fields.

Individuals develop visual literacy skills as they pass through these three primary stages. The first stage, visual cognition, is an internal mental stage. Visual information is first mentally comprehended, then remembered, created, and edited mentally before it is externalized. During the second stage, visual production, visual information is externalized or brought into the open through the design process where it can be reacted to and edited. Visual resolve, the last stage, is reached when the externalized visual product no longer needs refinement. It is finished when the producer has realized it has achieved its intended level of communication.

These three primary stages of visual learning contain seven hierarchical stages that explain more fully the visual learning process:

Organized within a model, the three

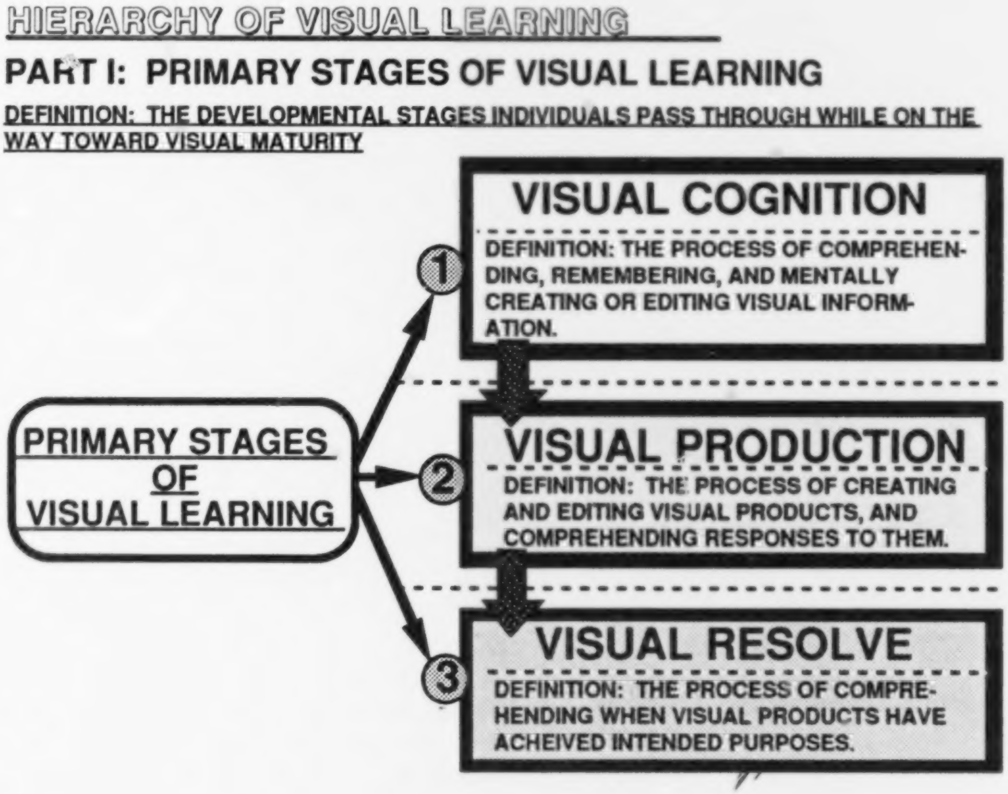

HIERARCHY OF VISUAL LEARNING
PART I: PRIMARY STAGES OF VISUAL LEARNING
DEFINITION: THE DEVELOPMENTAL STAGES INDIVIDUALS PASS THROUGH WHILE ON THE WAY TOWARD VISUAL MATURITY
PRIMARY STAGES OF VISUAL LEARNING
1
VISUAL COGNITION
DEFINITION: THE PROCESS OF COMPREHENDING, REMEMBERING, AND MENTALLY CREATING OR EDITING VISUAL INFORMATION.
2
VISUAL PRODUCTION
DEFINITION: THE PROCESS OF CREATING AND EDITING VISUAL PRODUCTS, AND COMPREHENDING RESPONSES TO THEM.
3
VISUAL RESOLVE
DEFINITION: THE PROCESS OF COMPREHENDING WHEN VISUAL PRODUCTS HAVE ACHEIVED INTENDED PURPOSES.

Figure 3

primary and seven hierarchical stages appear as shown in Figure 4.

1. Visual Perception: mental comprehension of visual information
2. Visual Memory: mental storage & retrieval of visual information
3. Visualization: the mental creation & editing of visual information
4. Externalization: creation & editing of visual products throughout a design process
5. Transmission: communication through visual products
6. Reception: comprehending responses to visual products
7. Resolve: comprehending the termination of a design process

The Hierarchy of Visual Learning (Figures 3 and 4) is offered as an example of how the overall umbrella of visual learning concepts can relate to visual literacy. The paradigms have been described as hierarchical, similar to Bloom's Taxonomy of Educational Objectives (1956) or Maslow's Hierarchy of Human Needs (1943). But hierarchical does not mean that one stage stops before another begins. The stages are not mutually exclusive; early visual learning stages continue to function throughout the entire process. For example, visualization continues throughout production and final resolve.

As can be seen in the model, visual cognition encompasses the three root concepts of visual learning: "visual perception", "visual memory", and "visualization." Gibson (1950, 1969), Travers (1982) and Eisner (1972, 1982) agree with the premise that visual perception precedes visual memory and the two make visualization possible. Figure 4 illuminates all three terms.

Visual perception has been defined as "the ability to mentally comprehend visual information". Visual memorization has been defined as "the ability to mentally store and retrieve visual information". And, visualization has been defined as "the ability to mentally create and edit visual information". It has been assumed, then, that when we discuss "visualization" we are talking about an individual's entire visual - mental processing ability which includes perception and memory but continues to operate throughout the primary stages of Visual Production and Visual Resolve. All stages are hierarchical, so earlier stages precede later stages, are in continuous operation during them, and are influenced by competency levels in them. These principles are being advocated (Wiley, 1989c) and implemented (Wiley, 1989b) in Technical Graphics curricula.

Amount of visual literacy at any level then, has a compounding effect, which is why it is a continuous goal of Technical Graphics throughout all stages of visual learning. Like words and paragraphs in verbal fields, and numbers and equations in quantitative fields, the visual language must be broken down into discrete elements which can be learned and manipulated to bring about desired results. The technical graphician has some of the same discrete elements common to others in different visual fields, elements and principles of visual communication such as line, shape, color, val-

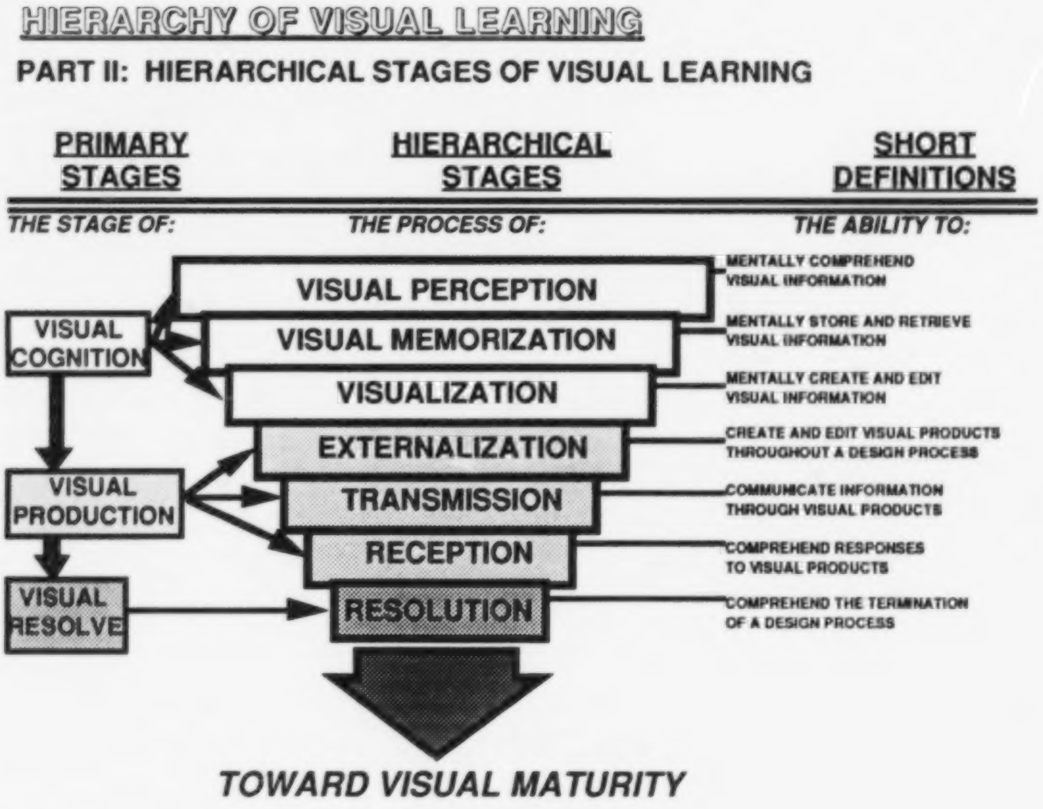

HIERARCHY OF VISUAL LEARNING
PART II: HIERARCHICAL STAGES OF VISUAL LEARNING
PRIMARY STAGES
HIERARCHICAL STAGES
SHORT DEFINITIONS
THE STAGE OF:
THE PROCESS OF:
THE ABILITY TO:
VISUAL COGNITION
VISUAL PRODUCTION
VISUAL RESOLVE
VISUAL PERCEPTION
VISUAL MEMORIZATION
VISUALIZATION
EXTERNALIZATION
TRANSMISSION
RECEPTION
RESOLUTION
MENTALLY COMPREHEND VISUAL INFORMATION
MENTALLY STORE AND RETRIEVE VISUAL INFORMATION
MENTALLY CREATE AND EDIT VISUAL INFORMATION
CREATE AND EDIT VISUAL PRODUCTS THROUGHOUT A DESIGN PROCESS
COMMUNICATE INFORMATION THROUGH VISUAL PRODUCTS
COMPREHEND RESPONSES TO VISUAL PRODUCTS
COMPREHEND THE TERMINATION OF A DESIGN PROCESS
TOWARD VISUAL MATURITY

Figure 4

ue, contrast, repetition, emphasis, clarity, etc. But the technical graphician may work in visual environments and processes that demand a different kind of visual literacy. The influence of industrial and business standards and computer technology forces a level of accurate communication through visual elements not always required in other visual fields. Therefore, student comprehension and manipulation of communication environments becomes a required goal necessary to achieve a desired level of graphic competency.

Communication is the root process in which lies the formal activity necessary to interact. Comprehension of this fact, and the detailed study of the cyclic process, helps students relate to their communication environment and with communication as a holistic process.

The identification of communication as an ultimate goal of graphics education should be unanimously subscribed to by graphics educators. Students should recognize communication as the process that it is. Process, in this usage, is to mean any phenomenon which shows a continuous change in time or any continuous operation or treatment. When recognizing communication as a process, events and relationships must be viewed as dynamic, on-going, ever-changing and continuous. Communication starts at birth

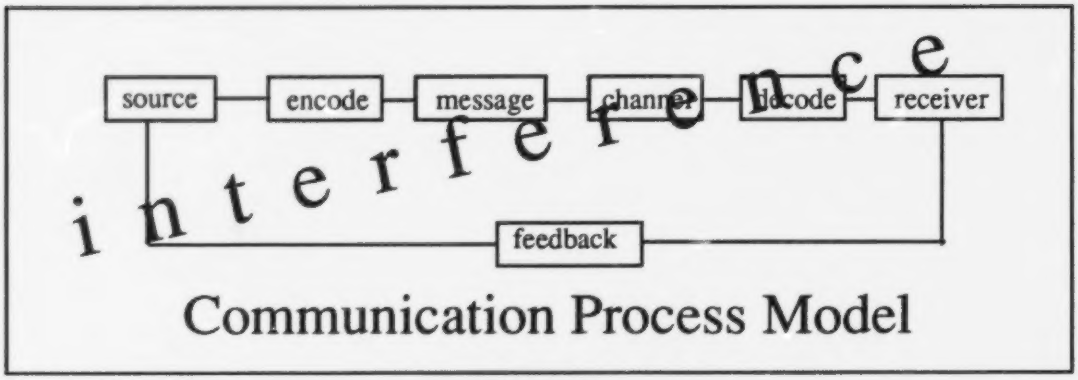


Figure 5

and continues throughout life. It is experienced through our senses and processed in our brains. It is always perpetuated with a response, either direct or indirect. Non-reaction to a stimulus is still a response that can be interpreted, etc.

A usable communication model has been pursued by various sources and has taken many forms. One such model was developed by a mathematician named Claude Shannon. Shannon explained it mathematically with the non-mathematician explanation being presented by Warren Weaver (Berlo, 1960). This model (Figure 5) is useful in describing communication processes. The only addition to the model was to include the constant disruptive element of interference. Interference is the undesired outside influence that tends to prevent the completion of effective communication. It can occur at any level or stage in the process. The goal of any communication is to eliminate or minimize the influence of interference and thus maximize effective communication.

It is believed that the teaching of the cyclic process of communication is a necessary activity for any graphics student. Constant reference to the elements of communication tends to help students isolate certain content to justify why graphic communications succeed or fail in producing the desired response.

Looking at some specific teaching in Technical Graphics of the theory of object representation known as orthographic projection, it is important to justify the location and relationship of views as a means to encode graphic information to facilitate consistent (and therefore successful) decoding in communication, that being one of the purposes of standards for engineering graphics.

The intent of identifying visualizing and communicating as the two primary behavioral goals of Technical Graphics education is to provide holistic goals that can fit within all disciplines. In this case, training in the communication process and the development of visual perception abilities can be provided by using concepts and content familiar to Technical Graphics.

VI. The Growing Need for the Technical Graphician

As technology continues to impact

visual fields the need to understand technical information about visual production methods will increase. This will necessitate new approaches to visual learning that can integrate computer processes with traditional techniques and media. And, as technology and computers proliferate in the work world, the need for visually literate technical graphicians will grow.

This principle was alluded to by Alvin Toffler, who popularized the idea of technological shock for the general population (1970). If he was right in his generalizing, then the visual producers of the future will have to assimilate a great array of visual concepts in order to deal with the complex task of producing visual information in a high tech environment. And technical graphics educators will endure the same in their effort to stay abreast of technological advancements.

VII. The Compatibility of Creativity and Technology

Creativity, as a teaching process or curricular goal, has sometimes been thought to be confined to specific non-technical disciplines such as the fine arts. In addition, some sciences claim the right to teach creativity, citing that science is the discovery or creation of new knowledge and is therefore a creative subject. Most educators could agree with this but might argue that creativity has no place in technology subject areas. Since technology has usually been thought of as the applied use of scientific knowledge, some educators, even traditional technical graphics educators, feel that creativity should not be an educational goal at all. One need only explore the history of traditional technical graphics curricula to discover a bias against creativity and an orientation toward "cook book", "round peg-round hole", and "tool manipulation" courses. Due to these limited views, technical graphics courses have usually been thought of as service courses for broader disciplines, such as engineering.

Are there other reasons why critics think of technical education as being more manipulative than creative? A partial answer may be a failure to recognize the technical sophistication that increasingly impacts the field. It may also be a failure to recognize the potential that creative technical graphics has to impact the rest of the educational community through its power to communicate visually. In short, the impact of technology on technical education, and specifically technical graphics, has been a "shock" that works against the realization of its potential. Technology has impacted the field so fast that it is hard for some to recognize that there now exists the means to change the way we teach and think. Technical graphics may even be able to play a major role in raising visual education to the status of verbal and quantitative fields.

Agreeing with the need for creativity in technical graphics is to agree with the need for a more holistic education. As Edwards (1979) suggests, it is naive to teach a curriculum that deals with the development of only one brain hemisphere (left). Traditional technical and engineering graphics education has tended to be mired down with analyzing, specifying and presenting graphics through industrial standards - a very left brain oriented activity. The analytical, restrictive, trade school perception of technical graphics has hindered the development of right brained creative activities in the field. But, if technical graphics can be taught as creativity aided by new technology, then it can lead to a more holistically educated individual.

The need to be educated in technical graphics should be recognized, as should the need to be graphically literate through technology. There is also another important curricular goal: to develop operational environments for students that will provide coping strategies in a variety of technological applications. The teaching of knowledge concepts, measured as behaviors, becomes a relevant and necessary goal of technical education. Thus, the inclusion of creativity with technology education becomes of primary importance in fulfilling and obtaining viable educational goals in technical graphics.

VIII. A Philosophical Basis for Visualization in General Education

Scholars have identified, codified, and recorded knowledge throughout the ages. This knowledge has been separated into disciplines and several disciplines make up a domain. There is not a consensus among all scholars as to the content of the domains of knowledge. The domains shown in Figure 6 are recognized by many scholars. The domains include: sciences, humanities, technologies, and formal knowledge. Formal knowledge represents language, linguistics, mathematics, and logic which provide form and structure to the other three domains. The one missing component in the formal knowledge is visualization. Visualization is an important prerequisite cognitive base for language, mathematics, science, technologies, and humanities. Therefore, it is an important part of general education.

Visualization is part of a much broader discipline called graphic science. Our children are expected to be educated in math, science, and the humanities but little or no effort is given to visual literacy. What is frightening is that our children are not only lacking in visual literacy education but many times they are discouraged from using their visualization ability, especially in the elementary grades. Daydreamers are disciplined for not paying attention. Children with rich imaginations are discouraged from us-

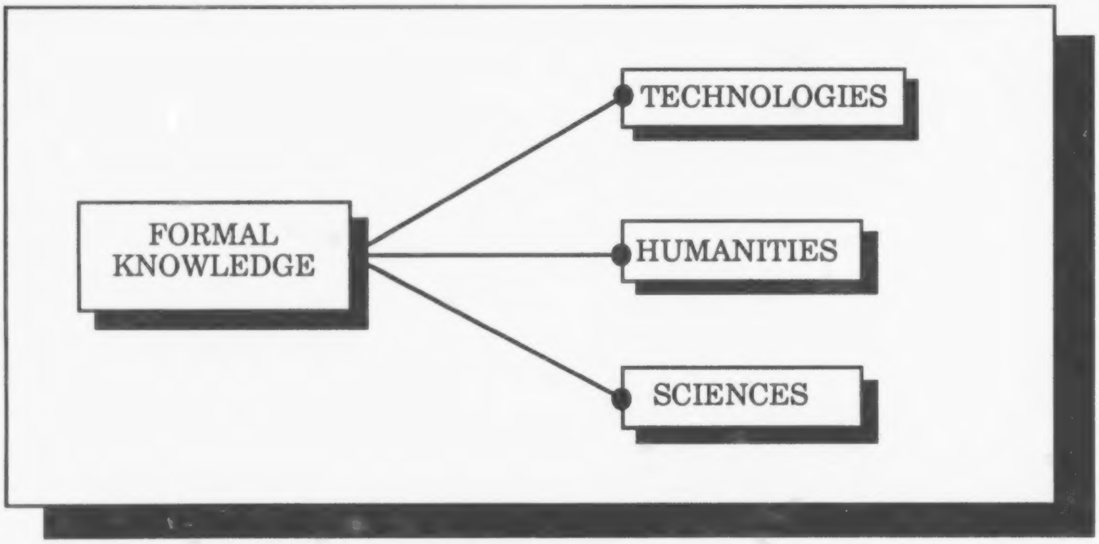


Figure 6

ing their visual skills. Mathematics is taught without regard to how closely it is tied to the real and imagined world. Science courses do not try to improve on visual skills which are so important in understanding chemistry, physics, biology, astronomy, and others.

Some of the most important people in science were successful because they were great visualizers. Successful mathematicians, chemists, and physicists usually have extraordinary visualization abilities. Visual literacy is important to survive in our culture and is an important prerequisite for success in science and other formal disciplines.

Because visual literacy is important to survive in our culture it can be argued that it is a formal discipline. All children should be taught this discipline starting at an early age and continuing through college. Visualization activities should be integrated into the other formal disciplines starting at a young age. Piaget and Inhelder (1967) or Wiley's (Wiley, 1990a) hierarchy of visual learning can serve as a model to begin curriculum development. Visual cognition would be the primary goals of the curriculum from K-3. Grades 4-6 would concentrate on visual production and grades 7-9 would focus on visual resolve. After ninth grade visualization instruction would be very specific and directed towards specific applications, such as visualizing the solar system or a chemical compound.

IX. Technical Graphics: A Prescription for Visual Literacy Education

Traditional technical graphics courses and curriculum material may not be appropriate for general education. However, there has been and continues to be a great deal of effort to link technical graphics to graphic science and further define both areas (Bertoline, et al., 1990). A major component of both technical graphics and graphic science is visualization. Much of the curriculum material developed for technical graphics can be used in general education with little or no modification (Bertoline & Miller, 1989).

Dedicated technical graphicians have a wealth of knowledge related to visualization. Success in technical graphics is related to degree of visualization ability of the student. Technical graphics instructors daily face the problem of improving a student's visualization skills. Techniques and curriculum material have been developed that could be valuable in the development of visual literacy in general education. There are literally thousands of visualization problems ranging from the simple to the very complex. Much of the theory underlying visual literacy has been developed within technical graphics. Most technical graphics instructors are computer literate and know how to apply the technology to visual literacy.

X. Summary

The authors propose the development of an interdisciplinary group that is willing to define, develop, and implement visual literacy within general education. Technical graphicians can be a resource for the early stages in the development of visual literacy in general education. Research has shown that there is a correlation between visualization ability and success in the sciences and engineering. There are numerous program development funding opportunities available to develop and implement visual literacy in engineering and science if it improves students' success in these disciplines.

Visualize this! Technical graphicians working with IVLA members to develop a model visual literacy curriculum for general education. An interdisciplinary approach is needed to find the solution to the visual problem in our educational system.

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A Visual Curriculum for Business and Scientific Students

Robert E. Griffin

For almost a quarter of a century the International Visual Literacy Association (IVLA) has promoted the value of using visuals in oral and written documents. IVLA has accomplished this with the organization's well regarded publications. Many ideas have been proposed over the years in those writings describing ways to teach visualization to students. Most of these proposals have centered on elementary and high school students. This paper documents a study at Penn State University that is developing a curriculum to teach the concepts of visualization to Master of Business Administration students.

The purpose of this paper is to document the first year of the multi-year study.

Developing the Visual Curriculum

The search for the perfect visual curriculum is an absurd proposition. Advocates of visual literacy will never develop the perfect selection of items to teach to everyone. The perfect curriculum will elude us because each of us require different elements from the discipline of visual literacy. At Penn State the need is to provide managers with fundamental ideas of visual literacy such as: visual information processing, oral/visual message design, written/visual message design and understanding of visual design. To decide what must be taught in this new curriculum a complete program of instructional design was undertaken. The information gathering phase of the instructional design program was divided into three parts.

Information Gathering-Round One

The first round of the program was intended to discover what business people thought was important in a visual curriculum. To do this the project team chose to use a business research tool called the focus group. A focus group is a gathering of people who fit the demographics required for the study. This group is questioned by a trained leader and encouraged to discuss the issues.

During this phase a variety of business people assembled in focus groups to discuss what they thought was important visual information to give to students. Thirty business people, assembled in a variety of different sized groups, were interviewed by the author during this one year quest. The interviews were audio taped and the conclusions were extracted from these conversations.

Participants in the focus group were invited to broadly discuss topics. During the focus groups many interesting comments were made by the participants. For example, many business people wanted any future curriculum to downplay the use of presentation equipment. These people felt that teaching students to use audio-visual equipment was a waste of time and demeaning to professional students. One manager said, "You don't need to take time teaching them how to use a view graph (ie. overhead projector) . . . everyone knows how to use that!" Yet, when pressed by the questioner, the item that most people said needed to be taught was proper audio-visual equipment operation. When they mentioned the topic of audio-visual equipment it was because they felt it was a failing in their own training.

The participants discussed many topics during the focus groups. The topics were wide ranging and covered a broad spectrum of communication concerns. In seeking to analyze the responses the research team believed the items clustered around seven separate categories. The seven clusters are shown in Figure 1.

Category	% Discussing
• Correct use of A-V equipment	71
• Using presentation software	68
• Using visuals in oral presentation	43
• Designing visual property	37
• Psychology of visual design	15
• Using visuals in written presentation	12
• Other	52

Figure 1 - Generalized Results of Managers' Focus Groups

The percentage associated with the categories was determined by the number of people who mentioned the category. Information that was mentioned by only one or two people, and often in what appeared to be just a passing comment, was classified as Other.

In addition, another group of items was judged to be relevant items, but did not deal with establishing a visual curriculum. Items in this category were classified as Other Communication items but are not included in this report. Items in that category were discussed by all the focus group subjects.

Approximately ten hours of audio tape was gathered during Round One; it was completed in July, 1991.

Information Gathering-Round Two

Round Two, which is just beginning, is intended to identify the content of the visual curriculum. While the business people questioned in the focus groups could adequately identify the major categories in which they believe instruction should occur, the participants did not feel qualified to specify the curriculum content within those categories.

To determine specific items of content to include in the visual curriculum, participants of the 1991 International Visual Literacy Conference were asked to list their recommendations. They should fall within the categories that were determined by the focus groups in Round One. As an example, for the category of Psychology of Visual Design, participants were asked to list the three items that they believe are the most important items to teach. It is anticipated that IVLA participants will list areas such as The Rule of Primacy and Recency or a particular model of information processing. Items mentioned within the categories may not adequately fit the category. This lack of conformity will be dealt with in the tabulation process. A sample of the survey instrument is shown in Appendix A.

Data collected from the visual literacy professionals will be collated, refined and listed by specific items. This process will be completed by a team of visual literacy experts by March, 1992.

Information Gathering-Round Three

Round Three will initiate the final phase of the process. This step will poll graduates of the Penn State MBA program to verify the current relevancy of the curriculum and investigate areas of weakness. At first this round will be conducted with graduates who left the program before the visual curriculum was initiated. Later, graduates who have been exposed to the new curriculum, will be polled to give continued validity to the curriculum. Round Three will be conducted every three years.

The Visual Curriculum

The Visual Curriculum, as it was proposed by the focus groups, includes five major categories of concentration. The Model is shown in Figure 2.

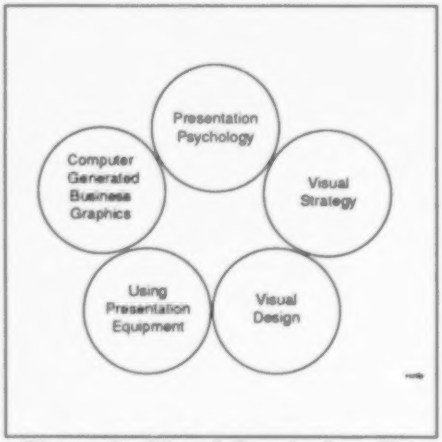

Presentation Psychology
Visual Strategy
Visual Design
Using Presentation Equipment
Computer Generated Business Graphics

Figure 2 - Visual Curriculum For Professionals

At the time of this writing the curriculum's design has been roughly determined by Round One of the study but has yet to be altered by Round Two. To describe the curriculum to date the major categories include:

Presentation Psychology - Topics will include areas about the study of the psychology of learning, perceptual psychology, and communication. Items will deal with research findings such as the Wharton Study of Visual

Effectiveness and the concept of Advance Organizers theorized by David Ausubel. Various models of communication theory will be included such as Berlo's Source/Message/Channel/Receiver model.

Visual Strategy - Topics in this area include how visuals are placed in a presentation. Strategies for using visuals in both oral and written presentations are included.

Visual Design - Topics in this area will be devoted to creating visuals that properly communicate their message. Technical presenters need to be able to create visual messages quickly and concisely. The variety of types of visual design will be explored. Topics in this area will include: value of 3-D graphs, using color, graph design and many other guidelines. Skills in this area should include mastery of those skills that were once the province of the graphic designer.

Using Presentation Equipment - This topic remains one of the most difficult to determine. Managers must learn to use presentation equipment but, as suggested by the participants in Round One, this topic should not demand too much attention. However, presenters must feel at ease with their tools. Devices covered will include flip chart, 2x2 slides, overhead transparencies, electronic visuals and the printed page.

Computer Generated Business Graphics - Topics in this area are centered on the variety of computer generated business graphics software packages that are available today. Topic coverage includes familiarization with software and the skill of using one or more packages. Care should be taken in this area to study managerial graphic packages rather than the more advanced art software used by artists.

Future Directions For The Curriculum

What will the future hold for the visual curriculum? Obviously the most important factor will be to keep the curriculum content relevant to the needs of the business and professional community. Oral presentation and writing curriculums have remained somewhat the same since the turn of the century. Visual curriculums, however, have been in constant flux. For example, new presentation devices are emerging that will have a dramatic effect on presentations. Equipment such as the thin film transistor projection display and desk top publishing have allowed us to use visuals for new purposes. The challenge for the visual curriculum will be to continue to teach the fundamentals of visual theory while allowing room for new developments. The visual curriculum must be a constantly developing process.

Appendix A

International Visual Literacy Association
Content Survey Form

Listed below are five categories of visual literacy. These categories were developed by business people during a previous phase of the study. You are asked to list the three items that in your professional experience tells you are the most important items to be taught within that category.

Please list your responses below:

A. Correct use of A-V equipment
  1.
  2.
  3.

B. Using presentation software
  1.
  2.
  3.

C. How to use visuals in an oral presentation
  1.
  2.
  3.

D. Designing visuals properly
  1.
  2.
  3.

E. Psychology of visual design
  1.
  2.
  3.

F. How to use visuals in a written presentation
  1.
  2.
  3.

If you care to:
Name: ______________________________
Institution: ______________________________
Phone #: ______________________________

From Conception to Completion: What Art Students Visualize

Darrell G. Beauchamp
Sandra R. Dowd

Introduction

Several definitions of visual literacy have been offered over the years and by now all proponents in the visual literacy field are familiar with the idea that students should possess the ability to "interpret and create visual messages" in order to survive in this highly visual world. Most definitions of visual literacy indicate that the skills of interpretation and creation can, to some extent, be taught and that once learned those skills can enhance a persons ability to communicate. Not only must the student of today be able to interpret and create visual messages, but, unlike their predecessors, they must be able to survive in a world of rapidly changing computer technology.

In their attempt to teach both the skills of visual literacy and microcomputer technology, the authors have modified other's ideas, creating an assignment for beginning art students which teaches both visual literacy skill and microcomputer technology. It is the purpose of this paper to describe that assignment and how it has been successful.

The Assignment

The original visual literacy assignment given to the group of community college beginning art students is found in Wileman's *Exercises in Visual Thinking* (1980, p. 28). Wileman considered the assignments outlined in the book to be one way of "providing teachers with a method with which to organize thoughts about the kinds of visual images from which to choose and the degree of visualization employed within a message" (1980, inside cover). The authors have discovered Wileman's exercise II (p. 28-31) to be an invaluable tool for the teaching of skills at a variety of levels. Mostly, the exercise is used to teach the concept of an abstract-concrete continuum in art, that is, an object or concept can be rendered at a variety and multitude of levels, complete from an actual object to an abstract concept

Clearly, research indicates that students at different levels of maturation or skill learn best from visuals designed at their level of expertise (Wileman, 1980; Beauchamp, 1988). Although there are many factors facilitating student achievement (type of visual used, method by which it is presented, individual student ability), it is evident that visualization of materials allows for greater achievement than does other non-visual methods of instruction.

Wileman (1980), Dwyer (1987) and others have identified varying "levels" of visualization, and although all offer roughly the same broad continuum, each offers a unique set of visualization within that its own continuum. Wileman (1980), for example, offered three broad categories in which symbols may fall along the abstract-concrete continuum: verbal symbols (noun labels, definitions, descriptions), graphic symbols (arbitrary graphics, concept related graphics, image related graphics), and pictorial symbols (illustrations or drawings, photographs, and 3-D model sculpture relief). Dwyer (1987) recognized four broad different types of visual illustrations: simple line drawings, detailed shaded drawings, photographs of models and realistic photographs.

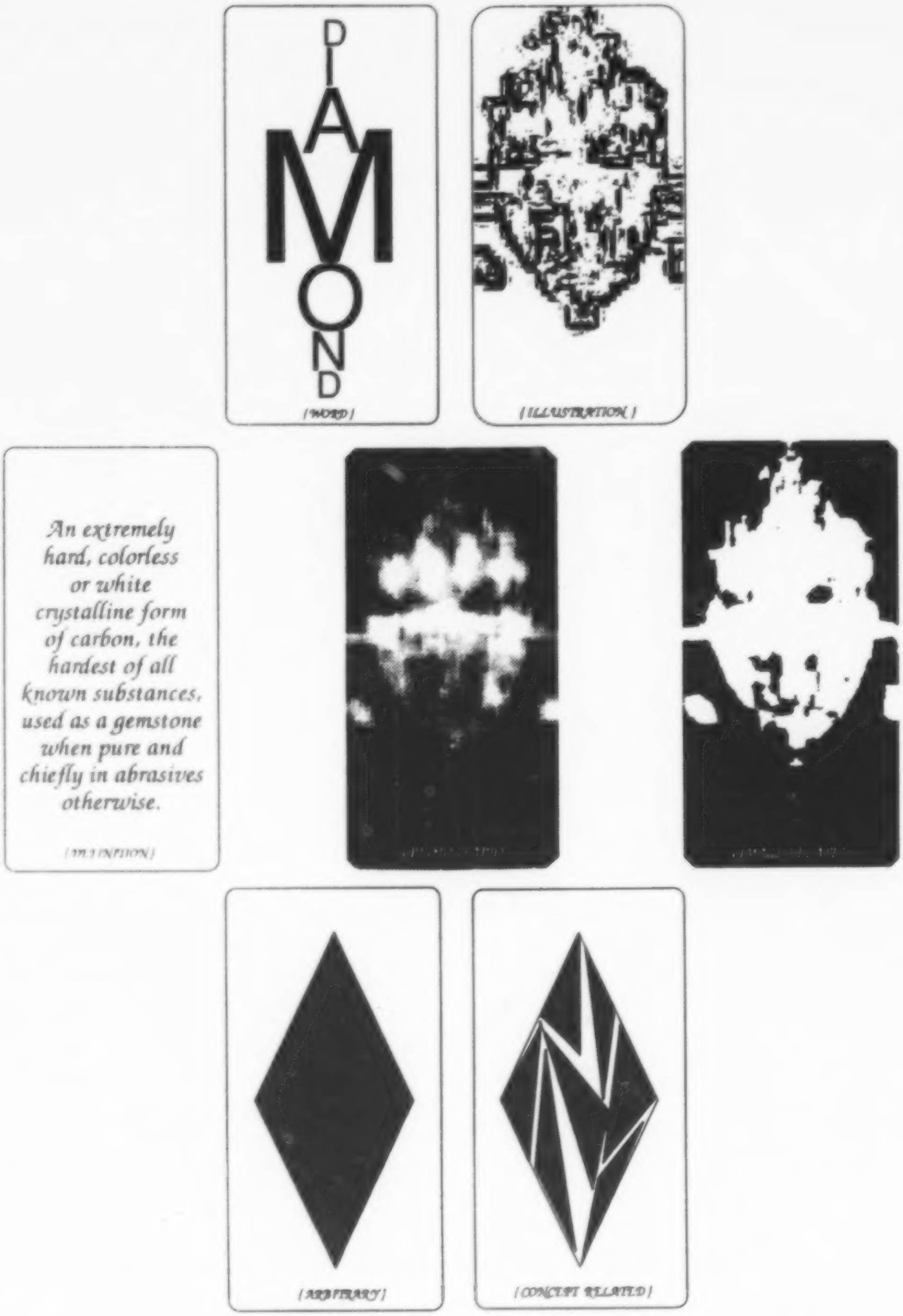
The authors use the Wileman exercise to not only teach the concepts of visualization and the abstract-concrete continuum but to also teach the microcomputer skills of image manipulation and creation. The assignment: "Design (on the MacIntosh) a series of representations of an object of your choosing at the following seven levels on the concrete to abstract continuum: photograph, illustration/drawing, image related graphic, concept related graphic, arbitrary graphic, definition/description, and noun label."

Doing the assignment

The students are allowed to start at either end of the concrete-abstract continuum, beginning with either the word representation of the object or with the physical object itself, working toward the opposite end. Although the authors give the students the option of starting at either end of the continuum, they, find that most students choose to begin on the concrete-end working toward the abstract. Students are encouraged to bring the physical objects into the classroom using those objects as guides for their computer renderings. Often during the assignment the computer art lab is strewn with objects being rendered on the computer.

It is a requirement that the final product, as well as each step in the completion of the project, be rendered using the computer technology. During the course of the assignment, computer skills are taught utilizing various hardware and software. Of vast importance is the students ultimate ability to utilize a variety of both hardware and software, determining for themselves which works best in their own situation.

Although the order in which the students can do the work is left to the student, most prefer to work from the concrete to the abstract continuum. To complete the assignment each student must either take or find a photograph of an object, scan that photograph into the computer, alter that scanned photograph to an illustration, eventually altering that image into its non-representational symbol at the abstract end of the continuum. All final artwork must be presented to the instructors as printed from the computer, no paste-up or further photocopying is allowed.


DIAMOND
[WORD]
[ILLUSTRATION]
[DEFINITION]
[ARBITRARY]
[CONCEPT RELATED]

An extremely hard, colorless or white crystalline form of carbon, the hardest of all known substances, used as a gemstone when pure and chiefly in abrasives otherwise.

Figure 1. An example of one student's finished product as delivered to the instructor to illustrate the abstract to concrete continuum for the object/item "diamond". Note the student's use of an "artistic" photograph of a diamond which altered the "look" of the diamond in the image related stage.

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Visual Perception in the Arts and Design: Curricular Issues and Other Musings

Don Stredney

"It's all in the mind y'know"
- George Harrison

INTRODUCTION

Inception and Objectives.

Throughout my training in the visual arts, I have always been fascinated by the process of vision. There were always the questions: How do we see? How does the eye process an image? What role does the brain play in our perception? And what are the implications to our aesthetics? Of course, there were very good classes on perception available through the psychology department, and art related courses usually provided a smattering of perception related issues such as Gestalt principles and color theory. However, what I was looking for was a course that made strong links between the recent findings from perceptual studies, neurophysiological studies, and artistic techniques used throughout the history of art, as well as current studio practice. What I felt was needed was a course that followed the entire process of vision and its impact in our lives, from the development of vision, to neurological processes, and psychological affects, in short, from vision through perception to cognition.

As an assistant professor, I decided to create a course that provided an *overview* of multidiciplinary investigations into the process of human vision and its relation to art and design. The visual system has been exploited by artists throughout time, and many times the artist have been exploited by their own visual system. The course would include examples of perceptual issues found within the schema of art created throughout history. It would challenge the students to choose, investigate, and implement one of the issues within the context of a visual project.

The course is intended to help the students sharpen their powers of observation, to consider aspects of vision that are common to all individuals, and to become increasingly aware of how cultural differences can arise in the use and understanding of visual imagery. In addition, the course serves to help the student transfer the theories of visual perception into practice.

During my investigations into the deluge of articles and texts written around the visual process and its relationship to art making, I decided to create the following outline of study, and supplement it with readings and lectures, as well as studio assignments. The following description contains the main topics of the course and the most salient features within each section. It should be noted that the topics are broken into ten areas due to the use of the ten week quarter.

1. THINKING ABOUT SEEING

The pervasiveness of vision in our culture.

The course commences with a discussion on the impact and pervasion of the visual system on human life. Associations are drawn to art, design, literature, religion, and science. No other human sense has, or continues to dominate our lives as deeply and completely as our vision. Yet, in looking at investigations into perception, we find that much of our perception occurs through unconscious processes, unseen if you will. The brilliant work of Jeremy Wolfe has shown that our visual system is comprised of a set of subsystems and that many of these processes are in fact hidden, and that "no amount of introspection can make us aware of the subsystems themselves." [1] Schopenhauer stated that "consciousness is the mere surface of our minds, of which, as the earth, we do not know the inside, but only the crust." [2]

Inevitably such a discussion leads to concepts of reality. And what we find in our investigations is that our perception, as may be our reality, is only a thin slice of the world around us. Our brains are wonderful results of evolution, an organ that embodies several complex systems that construct a paradigm of the world around us, as opposed to simply reflecting the "outside" world brought in by our senses. Our brains take in a limited slice of the available world, analyze and reconstruct a model, assign some meaning to the model and when necessary, allow us to catch a glimpse of a portion.

2. DEVELOPMENT

An evolutionary and comparative look at vision.

The studies of the visual system have come from comparative studies of animal models, transitional changes in developing systems, and fossil records. What becomes apparent is that Natural Selection plays a major role in the development of perception, and thus the various views of reality held by a living creature. Out of different environments arise different visual systems, with acuity and focus adjusted to assure survival in a particular environment. Through the different paradigms created by the brains of living creatures as it imparts meaning to a unique environment, arise different expressions of that paradigm. Out of such a system arise such myriad examples of expression that grace the artistic world and the world in general.

In his work, *Visual Thinking in the Ice Age*, [3] Randall White of New York University gives us a provocative look at the emergence of representation. The archeological records of man's existence on this earth which date back 2.5 million years, contain mostly objects that are utilitarian in purpose. It was not until around 35,000 years ago, in the Aurignacian period, that we find a sudden appearance of objects that have an intentional decorative or aesthetic purpose. White postulates that the increase in symbolic form was the result of cultural process. As societal status developed, the techniques for metonymy also developed. White believes that "close to the heart of these developments, is an increased ability to think in - and communicate by means of - special visual images." He believes that this increased competence might help us to explain the burst of technological progress that characterized the Aurignacian period.

White surmises this increase cannot be attributed to biological or neurological processes. Modern man - homo sapiens sapiens - evolved some 100,000 years ago with definite neurological advantages, (primarily cranial capacity), than homo sapiens Neanderthalensis, or Neanderthal man, whose skeletal remains have been found dating back to 80,000 years ago in Western Europe.

However, skeletal remains, which delineate cranial capacity, clearly cannot account for neurological developments such as new associative pathways and general plasticity, which would not survive intact. What might have occurred is that our ancestors evolved associations that permitted them to express representations that mimic nature or perhaps even express internal abstract representations in new ways.

White also mentions his colleague, Hindle, a science historian also at NYU, who studies the Industrial Revolution. Hindle believes the advances made during this time were due to the significance of techniques for image manipulation, such as the use of exploded drawings for conveying technical innovations. If this is true, we may be poised on the threshold of a new artistic convention that will present an entirely new medium for us to communicate, namely virtual reality or virtual environments created with computers. More shall be said on this matter in the section dedicated to mental imagery.

3. THE EYE

Anatomy and Function: Structural development, functionality and common pathologies related to the visual arts.

The course proceeds with studies of the embryological development of the eye and the advantages accrued from our ancient predecessors. Through a histological examination, we see that the eye is a direct extension of the brain. Through an overview of the anatomy and physiology of the eye, an analysis of the abilities and constraints of our vision is achieved. How these limits of vision have been exploited by artists and designers in the past, and how, at times, visual pathologies have affected their work are explored.

In his text, *The World Through Blunted Sight,* [4] the British opthalmologist Patrick Trevor-Roper presents examples of how visual pathologies of the eye have influenced art making in the past. We know that Claude Monet suffered from cataracts. It is possible to follow the change in the aesthetic as his vision worsened. It has been said that Monet, after recovering his sight through undergoing one of the earliest cataract surgeries, was shocked to see the colors which he had previously chosen. Supposedly he went rushing back to correct his canvases, to the consternation of his family.

Trevor-Roper presents further evidence of the influence of visual pathologies to the creation of visual work. He presents some interesting evidence that El Greco may have suffered from astigmatism, that Albrect Durer had a divergent eye, and that Edgar Degas, as his sight became progressively worse, turned to sculpture with which to manifest his artistic expression. Although other findings refute that El Greco suffered from astigmatism, [5] I believe such speculation can have great implications to our appreciation of art and our studies of art history.

4. THE RETINA
Anatomy and Function.

This section of the course covers the incredible specialization of the neural tissue known as the retina, which transmits optical quanta of light into graded potentials that are transmitted to the brain. We investigate the function of the rods which mediate night vision and function in dim light, and the function of the cones, the photoreceptors that permit us to distinguish the wavelength of the light, and thus allows the visual system and the brain to analyze an object in relation to its surroundings and create the experience known as color vision.

Because it is usually not considered part of the brain, the retina has been misunderstood as a simple receptor of imagery from our environment. However, further investigations have shown that the retina is a marvel of microcircuitry, an interface of neurons that play a crucial role in the preliminary interpretation of our world.

We can also see that the intimate relation of the eye and the retina are still maintained. It has been well established by researchers such as Cajal, Miles, and Barlow [6] that the brain sends back efferent fibers to the retina to modify the ways the retina encodes spatial information and its sensitivity to light. It becomes apparent that instead of the brain being a passive recipient of information from the sense receptors, that it is capable of modifying the ways in which it receives its information. This fact has staggering implications to our aesthetics. How can the artist create visual cues that are more numinous, and thus modify the perception of the viewer?

5. COLOR PERCEPTION
Normal function, limits, and color related pathologies.

There is probably no other visual cue that can convey such an emotional impact as color. What we soon come to understand is that color is a subjective experience, one that is best understood as a relation between the light reflected by a given surface as compared with that of its surroundings. As a subjective experience, it is fascinating to see the variety of color perception observed in a painting class.

Studies have shown that we process color in a unique way. Early in the 1800's, Thomas Young proposed the Trichromatic theory of Color Vision, that there are three different light absorbing photo-receptors in the eye. However, the theory failed to explain color phenomenon found in nature, and how certain color combinations cancel one another, but others do not. For example, we cannot perceive reddish-green or bluish-yellow. Later, the German physiologist Ewald Hering proposed the Opponent process theory, that certain colors (opponent colors) are mutually inhibitory.

Subsequently, it has been determined that we perceive color in stages. The first stage, at the level of the cones, is trichromatic. This was verified by the findings of three spectrally different cones, or more specifically, the pigments found in each cone. The second stage is an opponent system. This stage occurs later in the interpretation of the signals sent to the brain. From the work of Hubel and Livingtone, [7,8] it has been found that we process color separately from form. In fact there are separate neuronal mechanisms within the visual system that process color and form.

Through our understanding of color, we can see direct implications to the fields of art and design. For instance, in understanding color-blindness, designers need to be aware of how to create imagery that will include the color-blind population. (Consider the implications to vehicle gauges or traffic signs) We can see how artists that have poor color vision compensate for their loss by intensifying the chiaroscuro in their work and often delineate areas with bold black outlines.

As many artists grow older, a change in the use of color and their attention to detail can become evident in their work. This can be seen in the work of Rembrandt, for instance. And most importantly, we can see that in scientific visualizations information can be lost through improper mapping techniques, such as when employing color-coding as opposed to using luminance models to convey subtle changes in information.

6. BRAIN VISION

Structural anatomy and function of the visual pathway and visual cortex.

In this section of the course, we look at the structural components of the visual system, specifically the major pathways that transmit information from the eyes, to the primary visual cortex, and on to the associated areas involved in understanding images.

We look at the pioneering work of Hubel and Wiesel, [9] who delineated how the cells of the primary visual cortex are involved in the perception of the orientation of an object and by motion in a certain direction. We see that information, as it proceeds throughout the synaptic tree in the brain, becomes more blurred and more abstract.

It is here, in the neurological framework of the visual cortex, that we see a biological manifestation of David Marr's "Primal Sketch", the breakdown of the world into edges and directions. It is also here in the brain's cortex, where we see the output from the two eyes combined, where our understanding of spatial information becomes more acute. In the future we will begin to elucidate the neurological mechanisms of Gestalt principles. Livingstone has already speculated that the magnocellular system may be the site of Gestalt principles. [10]

7. BRAIN VISION II

Context and perception - the study of how the brain interprets images.

This section of the course looks at the various "psychophysical" methods used to study feature extraction in humans. These study are based on the "black box" approach, where we present some stimuli to an observer, obtain a response, and infer what might be occurring within the processes of their brains. Many of the inferences are based on correlations to known anatomy and physiology, as well as previous work in psychology.

For instance, much of what we know about how the brain works comes from studies of individuals who have some type of brain lesion. This may have occurred during a stroke, or perhaps during an unfortunate accident. However, these studies have provided us with a powerful map on which to construct a model of the workings of the brain.

More recent technological advances

have been developed that allow us to peer into the brain of an individual "in vivo". Positron Emission Tomography (PET) and Magnetic Resonance Imaging (MRI), and Electro-encephalography (EEG) have all improved our understanding of the hidden phenomenon immensely. Multimodal approaches to brain imaging have provided us with methods to correlate and integrate anatomy and function.

Some of the issues studied here are such phenomenon as negative afterimages. Albeit not limited to the visual sense alone, afterimages can provide us with strong examples of practical limitations of the structures we have previously studied. They present us with the concepts of neural fatigue and conditioned fatigue. Here we see a biological mechanism that may play a major role in our aesthetic appreciation of an image, and may provide us with an understanding of some mechanisms of memory.

Within this section we also study the work of Jeremy Wolfe who is at the Massachusetts Institute of Technology. [11] Through his work and others, we find that the sense of vision is not a single system, but instead a system made up a set of subsystems. By demonstrating how complex our visual systems are, we can help students to exploit these systems in their visual solution to problems.

Also in this section, we learn how perception is based upon previous experience. The brain is continuously comparing incoming perceptions with previously stored information. Often it is this information to which the visual artist is trying to communicate. It is as if they are teaching an individual with what they already know.

We explore the importance of context to perception, that how one can manipulate and establish different context, in order to convey different meanings to the same thing.

8. Illusions

Their use in the arts and design.

Illusions are, oddly enough, probably the initial impetus for research into perception. We are intrigued by the dissonance caused by what we see and what we know. The study of illusions is extremely important for the artist and designer. First, it demonstrates how our perceptions are limited. Second, it clearly shows how important context is in influencing perception. This second issue is what E. H. Gombrich termed "the beholder's share." [12] What an individual brings to bear on the content of the image is as important, if not at times more so, than the intended content.

Most illusions occur when stored paradigms do not account for what is seen. Other illusions can occur that are equivocal, or as Attenueave terms them "Multistable." [13] These are images that can be solved with two differing paradigms. Each solution is equally plausible. This phenomenon can be used by the artist or designer to create a feeling of uneasiness or disquietude. Knowledge of illusions can also help artists and designers to avoid unintentional ambiguity.

Included in the study of illusions is also the occurance of perceptual constancies. These are methods with which the brain has evolved to be used in maintaining a sense of stability in our environment. Light, size, and color constancies are a few, as well as some of the most powerful.

Perhaps in the final analysis, all artists, be they severe representationalists or abstract expressionists, are illusionists. We are all trying to create the illusion of a thing, or a feeling, or expression. Picasso believed there was no such thing as abstract art, only various levels of representation.

9. Hallucinations
Their impact on the arts.

We are all capable of undergoing hallucinations. By hallucination, I mean imagery so compelling that it can dominate our existence or consciousness. Some individuals with psychopathological disorders have hallucinations that to them appear so incredibly real, that they have difficulty distinguishing from "objective" (and that term is used rather loosely) reality, and their own.

What becomes apparent from studies of hallucinations is that there are internal schema that are common to individuals. People from diverse cultures, whether under self induced trances or the influence of psychoactive drugs, all report similar schema in their internally constructed imagery. Similar patterns such as zig-zag or spirals are common, as well as the impressions of scenes with greatly distorted perspectives.

The brain will also create its own imagery when deprived of stimuli. Studies of individuals in sensory deprivation studies have shown that, deprived for some length of time, the consciousness will shift back to imagery constructed in the brain.

Fatigue is another emotional state that can induce hallucinations. The reference often given is driving under severe fatigue, or performing any mentally intense task whilest deprived of adequate sleep.

By studying these phenomenon, artists can create imagery that can elucidate past experiences of similar emotional states. Also, artists can use the knowledge to search for new ideas. For instance, there is a state of mind called the hypnogogic state. This is the time preceeding sleep and just before fully awakening. It has been said that Salvador Dali used the hypnogogic state for inspiration. By pinching a fork between his thumb and index finger and staring at it while he held it over a dinner plate, he would slowly fade towards sleep. As he lost consciousness, his grasp would fail and the fork would fall to the plate, awakening him. It was also rumored that Edison used a similar technique with a rock. He would rock back in his chair and when entering the hypnogogic state, he would drop the rock, the sound of which would startle him enough to awaken him.

10. Mental Imagery
Mental representations and dreams.

What can be seen in the study of mental imaging and seeing is that they both employ similar mechanisms in the brain. The ability of an eidetic to literally scan an internal image, their eyes moving to areas as they would if confronted with the real environment surely presents strong evidence. Certainly we can all perform similar feats if asked where things are located in our homes. The eidetic may have simply developed more powerful associations to encode images that are presented for a brief time. Here, I believe it would be helpful to stress the importance to an artist to draw from internal representations, to construct their own still life if it were. The ability of decoding "their own" mental representations may carry over to the ability to decode stored images of the real, or "objective" world.

Investigations into sleep and dreaming have also provided us with new information concerning the mechanisms of the brain and visual representations. In fact, just as there are hidden visual processes, dream-like imagery may be occurring throughout our lives, from birth to death. Jung believed that dreaming occurred all the time, and that it became more prevalent when we sleep. It just may be that we are not privy to all that is going on in our heads.

The ability for visual mentation has often been linked to creativity. Kosslyn cites the example of Einstein imagining what it would be like to travel at the speed of light as a powerful example of the importance of mental imagery. [14]

Many artists have linked their creativity to internal visualizations. Some feel that the processes they are expressing are so abstract, that they themselves are first witness to these images when they manifest them on canvas. This may be an example of an artist expressing internal representations that are farther up the dendritic tree, that are more blurred and abstract, as found by Hubel and Weisel in their investigations into the brain's mechanism of vision. Perhaps we shall someday be able to express visually the concepts that Kant termed as neumenon.

Michelangelo used the analogy that he was like a musical instrument in the hand of God, and that his creations were nothing more that than the results of being played. Could this type of inspiration be the capacity of the individual to allow themselves to enter a hypnogogic-like state, and prevent themselves from making conscious decisions, yet during the process, they allow an unconscious paradigm control of decisions?

A' Posteriori

The possibilities of our elucidating the mechanisms of how our brains work and how they encode and decode imagery is certainly expanding. Along with the increased capacity to understand internal images, is our increased capacity to create new environments. The interest in "virtual reality or environments" surely attests to the fact. This growing field will surely prove to become one of the most significant developments of our century. The ability to create a virtual model of our world and perform untold operations to that model, will surely lead to new areas of scientific, artistic, and educational inquiry.

As we study our processes of vision, we come to realize that our visions and our memories are not copies of the worlds, but constructs, new worlds, that make sense(sometimes) to us. Kandel [15], states that when people, upon being told a piece of gossip, modify the story as it were, they may not in fact be confabulating. Instead they are recreating the story so that they can encode it into their world, or according to Myers, [16] assimilate it into their paradigm. So we become aware that to an extensive degree, our realities are subjective.

In closing, I am reminded of the wonderful story by the Taoist Chuang Tzu, from The Genius of the Absurd. [17] The story is of a student, who upon awakening, asks his master, "What is reality?" Whereupon the master replies, "I do not know. Last night I had such a vivid dream of being a butterfly, that I do not now know whether I am a man who dreamed he was a butterfly, or a butterfly now dreaming he is a man!"

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Seeing Our Past: Using Films to Review the Teaching of Teachers

Rhonda S. Robinson

Visual media inundate us all today, and many curricula and educators are attending to that fact. The popularity of media and film studies in the 1960's and 1970's has been replaced today with the proliferation of materials on critical thinking and viewing and on media literacy. The International Visual Literacy Association has had a large part in the development and promotion of new materials and ideas for teachers when considering the impact of visuals.

Films have been used throughout the century as a medium of entertainment and instruction. From their earliest use, films have been promoted as a worthwhile if not miraculous vehicle for teaching. Teaching films were first used with college and K-12 students for history and science education, but their subject matter expanded quickly to include many other topics (Reiser, 1990).

The early research in our field was based upon film and its power to inform, affect, and train. But it has been many years since film or even video was the major medium of research and inquiry in educational technology or visual instruction. This paper looks at early films developed to teach teachers, and presents an outline for the further examination of film as a text for teachers and educators of teachers.

The examination of film and historical films of course is not new. Film history has developed its own procedures and vocabulary over the past 50 years, and is a well-established area of communications research. However, much less has been examined when educational films are concerned. Only recently have many scholars turned their attention to the older educational films and attempted to begin to explain their messages, overt and hidden. Among these scholars are structuralists and post-structuralists who have in the past few years begun to analyze and discuss the messages of educational films (Ellsworth, 1990).

In her text, *The Ideology of Images in Educational Media* (1990), Ellsworth explains this recent move to examine the ideology of images. She points out that until very recently, educational communications research was still focused on effectiveness and on how learners gain from mediated messages.

With more educational media researchers turning their attention to educational films and video, the visual representations and the actual construction of knowledge are now being investigated. Ellsworth cites examples of film studies using science and health films and print materials.

Using Ellsworth's text as a model, this project proposes the examination of films used to teach teachers about communications media and "technology". Many such films have been produced and used in college classrooms to introduce the use of "amazing" new media such as film to future teachers. Most university film or media libraries have many such films in their collections, some dating to the 1940's and some as recent as 1990. These films, with titles such as *Teaching with Sound Film* (1940, Encyclopedia Britannica Education Corp.) and *Audio Visual Materials in Teaching* (1956, Coronet Instructional Films) were designed and produced to encourage future and current teachers to properly and effectively use 16mm films in their classrooms.

This project is based upon preliminary work on the above films. However, it is a direct extension of the work of Ellsworth (1990), and Erdman (1991), in recommending the examination of our past as visual texts. The extension of these ideas takes us into the examination of the films produced through the years to teach teachers about technology. These films have been distributed and used for the past 50 years, with the objective of encouraging teachers and future teachers to adopt the use of technology as an integrated and planned activity within the curriculum. The message of these films can be examined for change and for growth, but the overall goal of the films is fairly constant.

The project being recommended is twofold. First, there is concern that the history of our field, as represented by the films produced over the past 50 years, will remain unexamined and unquestioned. The film collections of many universities and cooperatives are aging, and are deteriorating with use and age. Some film libraries are concerned with space and with collection protection and condition. Because of these concerns, film libraries may in fact be considering the removal of films deemed no longer vital to their collections. Older educational films, especially those dealing with outdated technologies, may be those targeted for removal or even destruction.

Before this can happen, it is recommended that visual literacy and educational communication scholars investigate their collections at their institutions and make an attempt to save and archive film prints they deem valuable to the creation of a full "picture" of our history. While these films may always be available "somewhere," a project involving students in the examination of our history would be made much easier if the collections remain intact at each university.

Second, the recommendation involves the systematic examination of these films, and perhaps even the creation of a data base of characteristics and analyses. The accompanying worksheet is only a first attempt at identifying aspects of analysis. Erdman has provided much guidance in the detailing and analyzing of educational films. It remains to be seen whether her work requires further development when analyzing the "media" films from our past.

However, the examination of films is highly recommended, and the messages they contain should be recognized, discussed, and analyzed. Only by helping students or other scholars develop an understanding of our past can we attempt to understand our present situation or inform others about our future directions.

Films considered for this project include the following titles. Many others are available in collections throughout the country and the list should grow with recommendations and other suggestions as the project continues.

Teaching with Sound Film, c. 1940, Encyclopedia Britannica Corp.
Using the Classroom Film, 1945, Encyclopedia Britannica Corp.
Audio-Visual Materials in Teaching, 1956, Coronet Instructional Media.
Children Learn from Filmstrips, 1963, CRM/McGraw Hill.
Choosing a Classroom Film, 1963, CRM/McGRaw-Hill.
How to Use a Classroom Film, 1963, CRM/McGraw-Hill.
Film and You: Using the Classroom Film, 1961, BFA Educational Media.
Let Them Learn, 1967, Lundgrens Audio-Visual.
Visual Aids and Instructional Techniques, 1968, Wards Natural Science.
Learning with Today's Media, 1974, Encyclopedia Britannica Corp.
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With this as just a beginning, there is obviously much to consider and to attempt. The accompanying worksheet was drafted using details and questions Erdman (1991) recommended as a starting point. These questions have been posed about one of the films on the list. Those analyzing the film, graduate students in Instructional Technology found the questions to be valid and answerable.

The examination of our past could reveal to us how we believe media impact education. It could also reveal much about our beliefs about teachers, teaching, classrooms, and mediated education. Teaching films are visual history. They need to be examined from a 21st century viewpoint in order to ascertain what we can learn about ourselves and our world.

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Seeing Our Past: Using Films to Review the Teaching of Teachers

Participant Work Sheet

Please keep these questions in mind as you watch the film(s). (From Cherryholmes, 1988, *Power and Criticism* and from Erdman, 1990, *The Closely Guided Viewer*)

I. What is the organizational structure of the film? What segments can you form?

II. Can you outline the teaching lesson? What is the content of the lesson? How is the lesson presented?

III. What cinematic techniques are used? Can you analyze the film by detailing shots, editing transitions, sound, graphics, etc?

IV. What other messages are embedded in the film? What else can you learn from the film's "hidden curriculum?" Are there messages about classrooms, students, subject matter, teachers, and so on?

V. What idea in the film is most powerful for you?

VI. Who, what person or group, was rewarded or ignored by the ideas in the film?

TEXT
and
GRAPHIC DESIGN

Lexi-Visual Design of Instructional Materials

James S. Lenze

INTRODUCTION

The study of how to design print based and screen based materials to communicate effectively is enjoying wide research and heated debate. Despite this debate, research has yielded some interesting and at least somewhat consistent findings. This paper will provide the reader with some useful information towards structuring the outward appearance of a written document.

We are a visually dominated society (Pettersson, 1989). The idea that written documents should take a more visual approach is a highly accepted concept (Benson, 1985; Braden, 1985; Dwyer, 1978; Dodge, 1962; Pettersson, 1989; Rubens, 1986; Tinker, 1963).

Pettersson (1989) describes those representations which are read as **lexi-visual representations**. The overall purpose of this paper is to analyze how to best create these lexi-visual representations.

In order to understand these representations a rationale will be established for using them at all. This rationale will be rooted in cognitive psychology and will hopefully illustrate how a lexi-visual design approach will facilitate internal learning processes.

Once a rationale for lexi-visual design has been established, the paper will focus on research to reveal those design strategies which best facilitate internal cognitive processes. These strategies will apply to both print based materials and computer based training materials.

Finally, the paper will look at some of the fundamental differences between print and electronic text and try to demonstrate the need to look at the two mediums as complimentary instead of antagonistic.

The paper is structured in such a way as to facilitate better comprehension of the material.

1. Those titles which are in all larger capital letters and are centered within the column are primary headings for that section of text.
2. Those titles which are in all capital letters and are justified on the left are secondary headings and represent subsections to the three primary topics.
3. Headings in italics indicate what groups of paragraphs concern.
4. Words in bold print are the central theme to whatever paragraph they are located within.

A COGNITIVE RATIONALE

HOW DOES MEMORY WORK?

The first goal of this paper is to provide a rationale for Lexi-visual design. When it comes to layout designers may be satisfied with what "looks good." But if the designer's objective is to produce quality instruction then what "looks good" won't suffice.

What is Instruction?

By its very definition, **instruction** is external events which are systematically organized to facilitate internal learning processes (Gagne', Briggs, & Wager, 1988). These internal learning processes are known under a variety of names including mathemagenic learning.

Cognitive Processing Theories

Rothkopf (1966, 1970) coined the term **mathemagenic** to refer to those behaviors which facilitate learning and include those unseen and internal activities used by the learner to learn (Grabowski, In Press).

Similarly, Tobias (1984) refers to **macro processes** as cognitive activities used by learners to learn from instruction. Clearly, whether using the term mathemagenic or macroprocesses, the duty of the instructional designer is to aid the learner in using these cognitive processes towards the goal of effective learning.

Working Memory

One approach to assisting learners is through the careful, systematic selection of instructional strategies. In order to make appropriate selections the instructional designer must first make some inferences about how the human mind works cognitively. Gagne' (1975) provides a basic model of learning and memory which is used as a basis for many information processing theories (Gagne', Briggs, & Wager, 1988).

Beyond Gagne's general model are more specific attempts to analyze memory and learning. Kintsch and van Dijk (1978) see **short term memory** as a sort of buffer or storage area where statements are broken down semantically into their propositional parts. These propositional parts (or idea units) are processed in this buffer in groups called cycles.

A **cycle** of information enters working memory and is then divided into propositions. Propositions take several forms including important information, gist information, and recent information (Kintsch & van Dijk, 1978).

These **propositions** are used by the working memory to process new cycles of information. New information, that relates to recent information or is more important, is processed more easily than other kinds of information.

Baddalley (1986) identifies internal mechanisms, within working memory, which function to store and process these cycles of information. The mechanism which Baddalley (1986) identifies with visualization is the **visuospatial scratchpad**. This mechanism stores a visual copy of information for short periods of time.

Stine (1990) elaborates on this concept with an additional visual mechanism for **orthographic coding**. In her conceptualization of working memory it is this coding device which makes the copy of the visual information and then passes the information onto the visuospatial scratchpad to be broken down into smaller informational units or, again, propositions.

Stine (1990) provides an illustration which makes this process easier to understand. Cycles of information enter the working memory system the way meat enters into a sausage machine. As the meat goes through the machine it is divided into individual sausages which become part of a long string of sausages.

As the cycles of information proceed through the working memory it is coded into a visual copy and then broken down into smaller propositions (or sausages) by the visuospatial scratchpad.

But how this information is divided and then permanently stored in long-term memory is a function of the **central executive** (Baddalley, 1986; Stine, 1990). The central executive will examine the propositions and then, based on the information, begin to infer knowledge, elaborate on ideas, integrate the information with other previously received information, and organize the information so that the long term memory can understand it and make use of it.

The next question is how does the working memory know how much information is to go into a proposition or how much meat per sausage? Jarvella (1971) attempted to answer this question. Jarvella basically found that structured breaks in sentences provide natural cues to the reader to parse the information. These natural breaks take the form of pauses, clauses, and sentence breaks.

THE INSTRUCTIONAL APPROACH

Instructional designers can take **parsing** one step further by identifying those layout arrangements which effect mathemagenic processes in the mind (Grabinger, 1989). The need certainly exists.

Research has already shown that students don't always know what mathemagenic processes to use or when (Tobias, 1984). It is important to figure out whether instructional designers know as well.

Structuring Text

Studies have shown that utilizing specific textual structure facilitates recall of instructional text (Frase & Schwartz, 1979; Bernard, 1990). But there has been research which has shown contradictory findings to just how effective (Frase & Schwartz, 1979; Hartley, 1980). These studies attempted to produce a text structure which mirrored the mathemagenic processes of the learner. That is where the contradiction arose.

Mathemagenic processing cannot currently be seen within the human mind. These processes can be reported by the learner and behavioral outcomes can be observed but the processes themselves can not be seen in action (Grabinger & Amedeo, 1988).

The mistake has been to require the instructional strategy to imitate invisible mathemagenic processes. An alternative would be to provide strategies which the learner could then imitate mathemagenically or, in other words, direct the learner as to how to process the information.

This can be accomplished by accompanying the text structure with **directions** as to just how that structure should be used. Research has shown that when structure is systematically accompanied by directions as to what the structure means and how to use it learners utilize those mathemagenic processes which reflect the imposed structure (Anderson & Faust, 1967; Crouse & Idstien, 1972; Foster, 1979; Wright, 1980; Meyer, 1985; Hartley, 1986).

Comprehension, however, can be inhibited if the text elements are used too frequently or interfere with the desired processing (Anderson & Faust, 1967; Bausell & Jenkins, 1977; Hartley, Bartlett, & Branthwaite, 1980; Grabinger & Amedeo, 1988). For this reason great care must go into selection of strategies.

Until this point the term **text structure** has been thrown around without much of a definition as to what is actually meant by it. Jonassen and Kirschner (1982) divide text structure into two classifications: Internal textual structure and external textual structure.

Internal and External Textual Structuring

Internal textual structuring relates to structuring text by syntax and grammar. **External textual structuring** refers to those embedded strategies which focus a learner's attention on particular parts of the text. Examples of external textual structuring are arrows, bold face type, headings, and white space.

While this paper deals primarily with external textual structuring techniques it is unwise and impractical to ignore internal textual structuring techniques. To do so would be to ignore the entire cognitive approach to Lexi-visual design (Dillon & McKnight, 1990).

DESIGN STRATEGIES

Now that a cognitive rationale for Lexi-visual design has been established the next step is to actually address various strategies and examine how these strategies can best be employed to facilitate mathemagenic processing.

Suppose you were standing in New York and your boss gave you a toaster oven and told you to drive it to San Fransisco. You couldn't, because a toaster is the wrong tool for the job. Visual writing is a technique for telling the learner which mathamegenic processes to use for a particular learning task. If the instructional designer selects the wrong text structure for the particular learning task then the learner is, in a sense, being told to drive a toaster.

What follows are recommendations as to how and when to use various text structuring elements. A sincere effort has gone into providing techniques based on research rather than on preference. Still, efforts to examine every structuring technique, both interactively and independently, continue and not everything is known about textual structuring (Grabinger, 1989).

DIRECTIVE CUEING

Perhaps the most important directive cue is that of spacing. **Spacing** allows the instructional designer to illustrate cycles of information. A paragraph could represent a particular cycle of information and help the learner to break down the information into its propositional parts.

Line Spacing For Continuous Text

Line spacing is often refered to as leading and refers to the amount of spacing between lines of text. The amount varies according to the nature of the text.

When spacing between two continuous lines of text, it is important that the reader be able to discern between the two lines. The primary concern is that descenders (letters like g, p, and y) do not touch ascenders (letters like k, l, f, and b) from the lines below. Hartley (1987) recommends that at least 1.5 spaces between lines of text.

Benson (1985) argues for double spaced text for maximum legibility. Tinker (1963) and Pettersson don't rule out single spacing but suggest that double spacing is preferable when text size is optimal.

For electronic text Kolers, Duchnicky, and Ferguson (1981) and Grabinger (1985) agree that double spacing is optimal.

Line Spacing Guidlines

Paragraphs become more distinctive and easier to read if they are double spaced apart (Braden, 1983, 1985). This should also facilitate the identification of cycles of information for the reader.

Hartley (1987) recommends that two lines of space be left above and one line of space left below **major headings**. He further recommends that one line of space be left above and below secondary headings. For run on tertiary headings he suggests that one line of space be left above.

It is well known that **graphics** should be placed in direct proximity with their respective text (Benson, 1985; Haber & Hershenson, 1980; Braden, 1983; Macdonald-Ross, 1977).

Hartley (1987) recommends for tables, charts, and drawings that two lines of space be left above the graphic, one line of space be used between the graphic and its caption, and that two lines of space be used between the caption and continuous text.

Accenting Text

Within cycles of information are propositions to which the instructional designer would like the learner to attend to. One way to direct the learner to these propositions is to **accent** the the text in such a way that it stands out from the other propositions. Examples of accenting are underlining, italics, bold print, and using all capital letters.

Pettersson (1989) considers accenting techniques of be a relatively equal value. Underlining and All Capital Letters do, however, have unique problems about which the instructional designer should be aware.

Underlining and All Capital Letters

Issacs (1987) found that **underlining** in the middle of sentences made the lower line more difficult to read. Research on using **all capital letters** indicates that readers process capital letter more slowly than the combination of upper and lower case letters (Henny, 1981; Poulton & Brown, 1968). While this is not necessarily a bad thing Kinney and Showman (1967) state that without sufficient amounts of white space around words in all capitals the words will become difficult to read.

For these reasons it is recommended that underlining and all capital letters be reserved for headings and titles where they are surrounded by white space and don't adversely affect the lower line.

Color

Color is an accenting device which has received particular attention (Katzman & Nyenhuis, 1972; Whiteside & Blohm, 1985; Dwyer, 1978). Dwyer (1978) and Christ (1975) agree that color can benefit the searching of either print or electronic text.

Using color to accent text does have some restrictions. Approximately 10% of the male population in the United States is color blind, that is that they have difficulty distinguishing between certain colors or seeing color at all. Clearly, if color is the sole accent of the text 10% of the population may miss the meaning (Hartley, 1987).

Colors also carry meaning. Green generally carries the message of "go ahead" or money. Red is almost universally a warning color. When accenting text these characteristics need to be considered (Hartley, 1987).

Computers offer a special opportunity to use colors. Be careful, however, because 'hot' colors like pink can be seen to pulsate on the screen. Also, since color is basically free on a computer screen there may be a tendency to overuse colors. Use them conservatively and select colors that don't clash (Issacs, 1987).

Flashing Text

Blinking or **flashing** is another accent technique which is unique to electronic text. While this technique is excellent for grabbing the attention of the learner (Rambally & Rambally, 1987) it can also cause eye strain and fatigue if used for more than a brief period of time (Goodwin, 1972).

There is a fundamental warning, concerning all accenting, about overuse. If accenting is used too often it will lose its meaning to the reader (Bausell & Jenkins, 1977; Dwyer, 1978; Hartley, Bartlett, & Branthwaite, 1980; Benson, 1985).

In this paper bold face letters are used to signify words which are the central theme of paragraphs or sections of text and all capitals are used only in primary and secondary headings.

Multiple cueing is of little value unless the instructional designer intends for the accented information to be processed more than one way (Dwyer, 1978).

Graphic Cues

Another form of cueing is to use **graphic devices** such as arrows. The instructional designer should be explicit as to what these graphic devices mean and how they are intended to be used (Hartley, 1987).

Graphic devices provide a useful alternative to other accents because their graphic nature provides implicit meaning. For instance, in North America most people read from left to right and from top to bottom. Arrows can be used when the instructional designer wishes the learner to search for information which does not lie in the normal directional flow (Winn, 1989).

Lists

Putting information into **list form** can facilitate comprehension (Hartley, 1987; Frase & Schwartz, 1979). Recall of such information is further facilitated by the use of separation devices such as bullets, numbers, and letters (Lorch & Chen, 1986).

TYPOGRAPHIC ELEMENTS

Lexi-visual design does not solely deal with directional cueing. It is also a practice of designing text in such a way that the learner can more easily read and comprehend the meaning of the instructional text.

Imagine two roads which go to the same place. One road is paved and takes a short route. The other is muddy and winds through a dense forest. You would certainly be more likely to take the paved road if your goal were to get to your destination quickly and with minimal effort.

Typography is like the paved road. The systematic and proper use of typographical elements will make the task of informational processing a less stressful experience for the learner.

Typographical elements take several forms. Examples are font choice and size, line length, and margin size.

Line Length and Columns

Pettersson (1989) recommends that lines of text be no longer than 3 inches long. This supports the supposition that text be displayed in a two column format rather than one. Tinker (1963) and Pettersson (1989) both found two column text to work as well as the single column format.

Indentation

Indenting the first sentence of each paragraph improves legibility by seven percent for both single and double spacing according to Tinker (1963). The opinion is backed up by Frase and Schwartz (1979) who maintain that indenting the first sentence of each paragraph improves comprehension of printed materials.

With this in mind, some instructional designers may feel the desire to indent every other sentence to make them more distinct from each other. Tinker (1963) states that this practice does nothing more than slow reading speed unnecessarily.

Justification

Perhaps no other typographical element is used more often for the reason that it 'looks good' than **justified margins**. While what looks good is a matter of opinion what facilitates the reading process is a matter of research.

Most studies show no significant difference in relation to search time and comprehension of information between justified and unjustified text (Hartley, 1987). Isaacs (1987) states, however, that at least for some types of readers justified text is more difficult to read than unjustified. Specifically, Gregory and Poulton (1970) and Zachrisson (1965) found that poor readers have difficulty reading justified text.

This seems mainly because of the large gaps which may result from justifying text. While these gaps can be minimized through hyphenation this also presents a problem to poor readers.

An argument is made that the end of a sentence should be determined by syntax rather than by a set width of a line (Bork, 1982; Hartley, 1980). This technique is best suited for unjustified text.

A general recommendation would be to use text which is unjustified (Hartley, 1987; Benson, 1985; Macdonald-Ross, 1978; Pettersson, 1989).

Margins

Tinker (1963) states that **margins** are purely an aesthetic concern, but he meets with opposition. Pettersson (1989) states that margins serve three purposes:

1. They provide space for headings.
2. They provide space for comments and illustrations.
3. They provide space for fingers to hold the page.

Benson (1985) agrees with Pettersson (1989) and encourages generous amounts of white space.

Deciding, then, on the amount of space to use depends on the nature of the instruction. Computer assisted instruction (CAI) does not really require space for grasping fingers. Also, unlike print, there is no extra cost for space on the computer screen. The instructional designer can afford to be generous with white space on the screen.

Generally, a left hand margin of one and one half inches will provide enough space for notes, headings and fingers as well as any possible binding. The right hand margin is rarely bound so a margin of one inch should suffice. One inch top and bottom margins will also suffice.

SELECTING TYPE FACES AND SIZES

There are over a thousand **type faces** in printed text (Harley, 1987). To try and identify all of the appropriate fonts available would take a tremendous effort and would not be necessary. It is far more efficient to identify those characteristics which make up an easily read and comprehensible type face.

Upper and Lower Case

The need for **upper and lower case letters** in instructional text has already been discussed so those fonts which are only available with uppercase letters are automatically disqualified.

Serif Vs. San Serif

Type fonts with **serifs** have not been proven to have any significant effects on reading speed or comprehension (Hartley & Rooum, 1983; Lenze, 1990). Therefore type fonts such as Helvetica are just as good as type fonts such as Times.

Type Size

Tinker (1963) found readability limits in regard to **type size**. In general, text smaller than nine points is too small to be considered legible.

Advanced readers do not notice individual letters in words. They read letters as groups and recognize groups of words (Pettersson, 1989).

When font size is larger than twelve points, the reader must examine each letter individually to recognize it. This greatly slows the reading process down.

With this in mind, body text which will be read in continuous manner should be set between nine and twelve points (Benson, 1985; Braden, 1983, 1985; Haber & Haber, 1981; Tinker, 1963).

Hartley (1987) indicates that letters can be varied in size and even by type to differentiate different types of data. Within reason there should be no problem but if done carelessly the instruction will begin to look more like a ransom note.

The decision of which font to use should depend on the purpose and audience of the document (Benson, 1985). Christmas cards, letters to Mom and the like may invite the use of the ornate and stylish looking fonts. Professional documents, however, require maximum legibility. Therefore, select as simple a font as possible (Benson, 1985; Tinker, 1963; Pettersson, 1989).

PRINT AND ELECTRONIC TEXT DIFFERENCES

While print and electronic text share many characteristics, there are also some fundamental differences about which the instructional designer should be aware.

Although much research is yet to be done on the differences between print and electronic text, research to date demonstrates that people generally perform better with paper than electronic text (Dillon & McKnight, 1990). The reasons for this are as yet unclear. There has been concern that computers have a fatiguing effect of users.

Gould and Grischowsky (1984) attempted to determine if this fatigue was due to the machine or the task. While fatigue did not show as a difference between print and CBT, learners did proofread from print 20 to 30% faster than learners proofreading from CBT.

Wright and Lickorish (1983) also found CBT users to be slower and less accurate in their instructional tasks. Hartley (1987) suggests that there may be differences in the way learners cognitively process information from CBT.

Unique Characteristics of Electronic Text

Electronic text has some unique characteristics which make it different than print based materials.

With print based materials there is generally one way to go from one page of information to another. With the computer there are three: Paging, windowing, and scrolling.

Paging is much like turning the page of print. One screen of text is replaced by a completely new screen of text.

Windowing refers to the computer's ability to allow a frame of information to appear on the screen in any location. Generally, the user has the ability to remove the window when necessary.

Scrolling refers to the computer's ability to move text up or down the screen to reveal more text.

Although scrolling text allows the computer to put large amounts of text on one screen research has show that learners have a harder time comprehending text from screens which scroll (Kolers, Duchnicky, & Ferguson, (1981); Burg, Boyle, Evey, & Neal, 1982). Likewise, research has shown that paging is also superior to scrolling both in performance and learner preference (Schwartz, Beldie, & Pastoor, 1983).

Converting Materials

If an instructional designer were to convert existing print based materials into CBT materials there would be problems.

Firstly, most print based materials are usually oriented on a page in "portrait" configuration (taller than wide). The majority of computer screens, however, are oriented towards the "landscape" configuration (wider than tall). While this limitation is probably only temporary it is still a concern for the instructional designer.

Secondly, since the computer screen is generally smaller than the page, layouts can easily become cluttered. (Martin, 1973) warns against such **clutter** as it interferes with processing.

Thirdly, CBT generally requires a higher degree of **interactivity** than page materials (Ng, 1986). Print based materials, being converted for CRT display, may have to be redesigned to the point where the instructional designer might just as well start over from scratch.

Fourth, while space and color are free as compared to print (where they certainly are not) **memory** is often a premium. Graphics can drain precious computer memory.

Lastly, it is important that a graphic be placed as closely as possible to its related text. With limited screen space it is often difficult to place the text and graphic on the same screen. Hartley (1987) wisely suggests that CBT and print based materials are not mutually exclusive and that a workbook can accompany CBT materials so that text and graphics can be viewed at the same time.

CONCLUSION

Both print based materials and computer based materials will continue to be developed by instructional designers. Since the primary goal of designed instruction is to systematically organize external events to facilitate internal processing (Gagne', Briggs, & Wager, 1988) it would be foolish to ignore internal mental processes when designing such instruction.

By forming an understanding of how learning occurs, mathemagenic processes can be identified which facilitate learning of different tasks.

Taking a lexi-visual approach to structuring text and informing the learner as to how to use that structure should facilitate the design of effective instruction.

Differences between print based materials and CBT exist but they may in fact be optimized to enable them to function together.

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The Evolution of Publishing Technology: Five Eras of Change

Roberts A. Braden
Richard F. Hannemann

History

Who did the earliest publishing? We don't know the answer to that question, but we do know something about that person. He or she was a cave painter, a creator of drawings and petroglyphs. We can only speculate about whether that first publisher was more an artist or a story teller, whether the painted and chiseled images were the message itself or "visual aids" used to illustrate campfire tales. We are left to speculate also as to whether that first publisher was primarily a reporter, an historian, an entertainer, an educator, or some combination.

Speculation aside, what do we know about the first publisher? We know that he or she brought about a paradigm shift in the art of communication. That first publisher was responsible for the new (at that time) notion that information could be recorded for future reference on some medium other than the human memory. Moreover, an implicit aspect of recording information on a non-human medium is the potential for non-human delivery of that information.

In artistic worlds an old axiom holds that form follows function. In the case of publication, history bears out that axiom. Although messages that could be displayed upon cave walls evolved from simple recognizable pictographs (pictures of things) some 40-60,000 years ago into ideographs and highly symbolic hieroglyphics just 10,000 years ago, the functions of the wall did not change even though there was a proliferation of forms that could be displayed on the wall. Therefore, we see publishing form following wall functions for a thousand human generations or so. The primary functioning of the wall was shelter, and only secondarily was it a medium of communication.

The first important functional shift came with the development of portable writing surfaces, primarily cured animal skins, papyrus, and eventually paper. The changed function that came with portability was the ability to send messages rather than just leave them. With the emergence of transportable documents, the communication function became primary.

A second functional shift occurred when the systems of symbols were enlarged to express sounds as well as ideas. That shift changed publication from the single task of visualizing ideas into the more complex dual task of visualizing both ideas and language. The resulting two faceted paradigm of transportable writing media coupled with language-based symbolic meaning has been the framework within which all publication existed until the 19th century. It is still the dominant paradigm as we head into the 21st century.

Of course along the way there was the advent of movable type. The Gutenberg press and other mechanical improvements which soon followed created added functional capability and thus changed the form of published material. Hand drawn illuminated manuscripts, the handiwork of monks and scribes gave way to black type imitations and later to stylized, highly legible texts that were quickly and inexpensively mass produced.

Four Factors

Four factors that have affected all eras in the history of publication will be considered here. The choice of only these particular variables was a judgement decision on the part of the authors.

First is *craftsmanship*. The elements of craftsmanship which are most intriguing as we follow the development of publishing are pride, skill, the transmission or sharing of skill, and the bonding of persons with similar skills into elite social groups ranging in complexity from simple cliques to formal trade guilds. Of particular interest is the evolution of the roles played by the elite craftsman whenever the technology of publication has changed. At the same time we observe the emergence of new roles, new crafts, and therefore, new elites.

Second is *visual style*. Most of what passes for style in publication is related to the processes of design. At the present time the style element which is drawing the most attention is type, i.e. which fonts are in fashion and which are not? "According to New York designer Paula Scher, type treatments that are suddenly everywhere are just about to be nowhere— their overpopulation breeds their extinction." (Feleci, 1991, p.71) A brief list of the design factors which reflect what is in or out of style are:

- layout
- typography, including type styles
- illustrations: continuous tone & line
- color

Third, and closely related to style, is the factor of *values* (aesthetics). What a fifteenth century printer considered beautiful seems dark, dreary, and a bit too fancy as we approach the twenty-first century. The look of the text on a four hundred fifty year old printed page will not have changed over the centuries except for some yellowing of the paper and fading of the ink. [See figure 1.] What has changed in regard to that page is the prevailing aesthetic judgement. Modern values, not ancient ones, now apply to judging the way that the page appears, to the way that we value its design, to the way that we feel about what we see. Long before the desktop era, W. A. Dwiggins made the point about the prevalence of current values: "We all love the old printers . . . But . . . Our design is contemporary. It can't help being so. You can't copy and repeat successfully even the most beautiful typography of another time—because you did not live that time." (see Zapf, 1972, p.14)

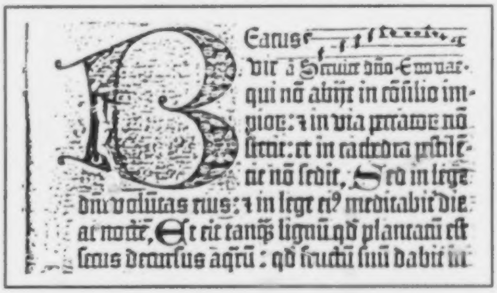


Figure 1: Printed page from 15th Century

Fourth, there is the *mystique* of publication. In some ways the printed page is analogous to the magician's white rabbit. We (lay persons) know what it is, but even if we suspect how it got there, we're not quite certain. Of course mystique has contributed over the years to the maintenance of the elite status of journeyman typographers, pressmen, engravers, compositors, and others. The mystique can be and has been maintained because the public traditionally has accepted the implication that exceptional talent and skill separated the average citizen from the competent printing craftsman. From a practical standpoint, those who read things that have been published really have no need for knowledge about how the text and images get onto the printed page.

Five Eras of Publication

The history of publication is rich in milestones. Thus in an effort to make more manageable the discussion of the evolution of publication, the authors have arbitrarily chosen a few milestones and in the process have partitioned publication history into five eras. Chronologically they are:

- The Pre-Gutenberg Era
- The Gutenberg Era
- The Linotype-Monotype Era
- The Electronic Era
- The Desktop Publishing Era

Our primary concern is with the current era, that of desktop publishing (DTP). However, if each era represents some major shift— whether in process, technology, sociology, or whatever— there are carryover elements from one paradigm to another, from one era to another. Accordingly, any useful explanation of currents in the present requires at least a brief examination of the events which went before.

The Pre-Gutenberg Era

Origins of writing

Early development of society was a time when our forefathers lived in caves and fed themselves by collecting fruit and roots. Early attempts to record events of importance may be seen in petroglyphs of hunting scenes and magic rituals. Next in history, ideograms— simplified drawings of real objects— were used to express symbolic meaning. At first the objects drawn did not represent words, but rather attempted to convey thoughts. These symbols were independent of language, hence, an understanding of language was not necessary to understanding the ideogram; the two were not yet bound together. Pictographs were simplified versions of objects used to express abstract ideas. The pictograph began to take on the sound of a spoken word; thus writing became phonetic. [See figure 2.] Analyzing this evolutionary process Kapr makes the point that, "Writing and drawing have the same origin." (Kapr,1983, p12). We can trace the development of our alphabet through Egypt, Phonecia, Greece, and eventually to Rome. More specifically, our alphabet was probably invented in the eastern corner of the Mediterranean less than two thousand years before Christ. (Kapr, 1983)

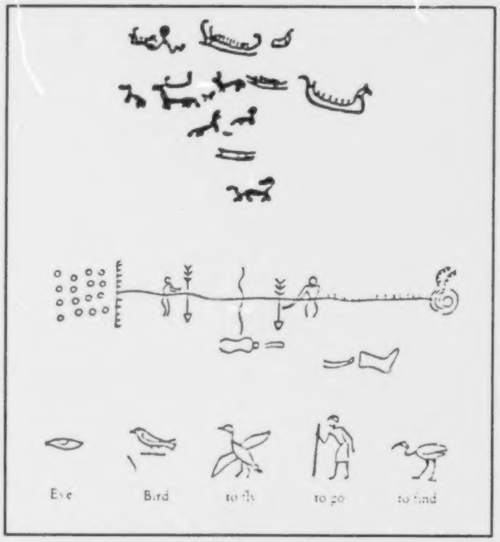


Figure 2: Rock drawing, ideogram, and hieroglyphics

As soon as writing existed, creative people naturally tried to make it look beautiful. Consequently, the tradition of illuminated, decorated, and illustrated manuscripts has had a profound effect on typographers and graphic designers.

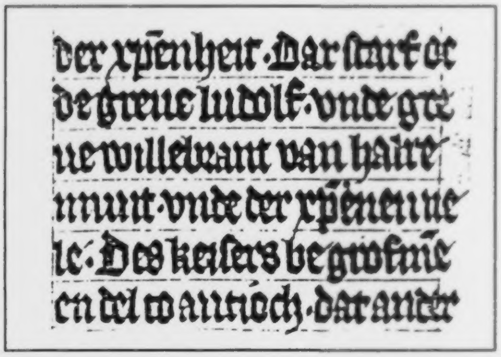
Origins of Printing

Paper was invented in China, about 105 years before Christ by Ts'ai Lun, and the knowledge passed slowly from East to West via the Arabs and North Africa. The first paper mills in Europe were established in Spain in AD 1150, Germany in 1389, and England in 1490. (McLean, 1980)

In China, printing from wooden blocks was flourishing. The "Diamond Sutra", dated 868, was long thought to be the world's first printed book; but we know today that earlier Korean examples printed from baked clay precede this by at least 100 years. (McLean, 1980)

The development of printing from movable type made of baked clay is credited to Pi Sheng in China between 1041 and 1048; and the Koreans were casting type from metal, and printing books from it, before 1400. Because writing in these far eastern countries relied on a set of symbols, counting some forty thousand in number, the invention of movable type was minor in comparison to printing from carved wooden blocks. (McLean, 1980)

In the early fifteenth century, European books were normally written entirely by hand on parchment or vellum (the prepared skins of sheep, goats and calves), and also on paper made from linen rags. Naturally, the style or design of these books depicted the taste and spirit of the times. This work, done by scribes (usually Monks) reflected their religious beliefs and the individuality of each scribe. [See figure 3.]



der xp̄enheit·Dar ſtarf de
de greue ludolf·vnde gre
ue willebrant van halre
munt·vnde der xp̄enen me
le·Des keiſers begrofnis
en del to antioch·dar ander

Figure 3: Text from hand scribed book

Books were illuminated with large letters and illustrations to give praise and add to the implied worth and value of these rare volumes. Art and illustrations used to illuminate books were miniature examples of the painting and illustration styles of the time. Books written by a single scribe also differed, based on the mood and level of fatigue of the scribe. Relatively few books could be produced in this manner. Consequently, only the wealthy could afford them. The few books which did exist were concentrated in the libraries of monasteries and universities or in the rare private libraries of the wealthy. (Levarie, 1980) Knowledge was still disseminated among ordinary people by word of mouth.

By the end of the fifteenth century education was spreading, universities were being founded, and some method for producing books more efficiently was needed. At that time all of the essential ingredients for printing books in larger quantities existed in Europe. Paper was in ample supply. The screw printing press was being used by bookbinders to block print textiles. Oil-based ink was available for decorative purposes. The remaining missing component was a method of producing large quantities of type.

The Gutenberg Era

Johann Gutenberg (1398-1468), after more than ten years of trial and error, invented metal movable type about the year 1440. Trained as a goldsmith, and living in Mainz, Germany, Gutenberg already knew how to cast objects in metal, how to cut punches, and how to stamp letters and images on metal. Gutenberg utilized his knowledge of metal, and the inventions already available in his time, to create the first integrated system of typesetting, printing, and type storage-- a system of reusable movable metal type.

In order to have his work accepted by clients and patrons, Gutenberg believed that the look and style of a printed book should match, as closely as possible, the look and style of hand lettered manuscripts produced by scribes. In order to achieve this, Gutenberg's font consisted of over 300 letters and ligatures needed to simulate the handwritten method of the scribe. (McLean, 1980). The term "black letter" or "gothic" is now used to indicate the style of the type Gutenberg used to simulate the look of the scribes.

Gutenberg created his type by cutting a punch with the type character in relief and backward reading (in reverse). The hard punch was struck against a softer metal, producing a hollow matrix. [See figure 4.] By fitting the matrix into a mould, a character could be cast by pouring molten metal into the mold.

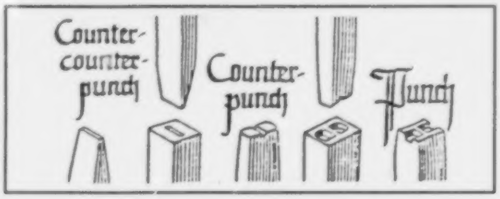
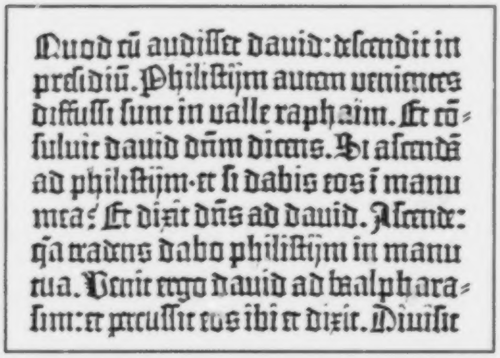


Figure 4: Creating a punch

Gutenberg's real genius was inventing a mold of varying width, so that characters of different widths, such as the "i" and "m", could be cast using the same mold. This was the core of his invention. (McLean, 1980). Gutenberg also had to solve the problem of what metal to use for casting his type. He eventually selected lead, with the addition of antimony for strengthening and tin for toughness and to make the metal melt more easily. Gutenberg produced a variety of works with his new invention, but Gutenberg's most famous work is the 42-line Gutenberg bible, printed from about 1452 to 1455. [See figure 5.]



Quod cũ audiſſet dauid: deſcendit in
preſidiũ. Philiſtijm autem uenientes
diffuſi ſunt in ualle raphaim. Et cõ-
ſuluit dauid dñm dicens. Si aſcendã
ad philiſtijm· et ſi dabis eos ĩ manu
mea? Et dixit dñs ad dauid. Aſcende:
q̃a tradens dabo philiſtijm in manu
tua. Venit ergo dauid ad baalphara-
ſim: et percuſſit eos ibi et dixit. Diuiſit

Figure 5: Partial page from Gutenberg Bible

Gutenberg borrowed money from a variety of sources, including Johann Fust, a goldsmith. A condition of Fust's several loans to Gutenberg was that he join Gutenberg in partnership. A subsequent suit over repayment of the loans resulted in Fust taking control of Gutenberg's equipment, effectively forcing Gutenberg out of the business. Among witnesses for Fust's suit was a former scribe named Peter Schoeffer, employed in the enterprise. The 42-line bible was probably produced when the three men were working together with the backing of Fust's funds. If Gutenberg is credited with the invention of metal movable type, then Fust and Schoeffer should be credited with making the enterprise a success.

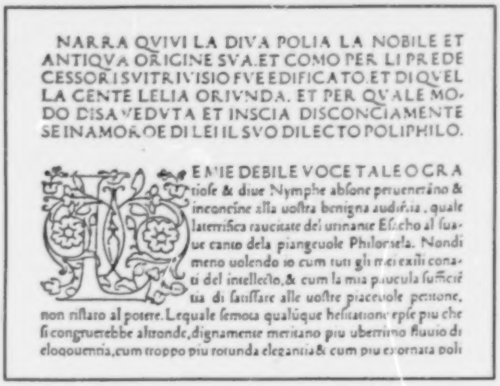
Techniques in cutting the punches were refined by Schoeffer, and other printers who followed. German printers continued to favor the black letter or gothic type used by Gutenberg. Printing spread from Mainz to many of the other cities in Germany, and from Germany south across the Alps into Italy. As German printers were retained to introduce Gutenberg's invention into other European countries, it was necessary for each new printer to also became a typecutter-- in essence, a typographer.

Type designs changed in each country to suit the writing styles preferred by their customers based on the culture and aesthetics of each country. For example, Italian humanists preferred Roman to the German black letter. Gradually, type was designed for a new aesthetic rather than to imitate the hand written work of scribes. Thus a rich tradition of fine typography in Italy, France, and England was established— each contributing to our modern day aesthetic of type as beautiful writing. [See figure 6.]

According to Zapf (1972, p.5),

> The books of the three great Venetian printers, Jenson, Ratdolt, and Aldus, show a wonderful harmony of style, form, and content. Only a few decades after Gutenberg, a pure typographical form had crystallized. The "Hypnerotomachia Poliphili", printed by Aldus in 1499, is a typical book of the Renaissance period, showing a unity of

content (text) and form (type, typography and illustration) which truly reflects the vitality of spirit and intellect of that time.



NARRA QVIVI LA DIVA POLIA LA NOBILE ET
ANTIQVA ORIGINE SVA.ET COMO PER LI PREDE
CESSORI SVI TRIVISIO FVE EDIFICATO.ET DI QVEL
LA GENTE LELIA ORIVNDA. ET PER QVALE MO-
DO DISAVEDVTA ET INSCIA DISCONCIAMENTE
SE INAMOROE DI LEI IL SVO DILECTO POLIPHILO.

E MIE DEBILE VOCE TALE O GRA
tioſe & diue Nymphe abſone peruenerano &
inconcine alla uoſtra benigna audiẽtia, quale
laterrifica raucitate del urinante Eſacho al ſua-
ue canto dela piangeuole Philomela. Nondi
meno uolendo io cum tuti gli mei exili cona-
ti del intellecto,& cum la mia paucula ſufficiẽ
tia di ſatiſfare alle uoſtre piaceuole petitione,
non riſtaro al potere. Lequale ſemota qualũque heſitatione epſe piu che
ſi congruerebbe altronde,dignamente meritano piu uberrimo fluuio di
eloquentia,cum troppo piu rotunda elegantia& cum piu exornata poli

Figure 6: The typography of Aldus Manutius,1499.

Type design was however, limited by the need to cut punches in every character, and, in every size required to print. There were very few people alive at any one time who had the talent to do this, and the labor required to cast characters was tremendous. What was needed to keep pace with increasing demand for printed works was some method of making the process faster and less dependent on the talent of an individual to accurately cut a type punch. This was not to occur until 430 years after Gutenberg.

The Monotype-Linotype Era

As the printing and punch cutting trade became more widespread, these two crafts were accomplished by different business enterprises. The printer printed and the type founder created the single type characters (called "sorts") used by the printer. Printing presses were larger, publications were longer and printed more frequently. All of this required an army of compositors to set the type by hand. The printing and publishing industries were hungry for type, and hand cutting punches continued to require a huge amount of labor. With the advent of steam power, it became possible to automate a variety of machine activities.

In the 1880's two American engineers, working independently, brought out machines to mechanically set type which operated on very different principles. Historically, type had been cast as individual characters, then assembled into lines of type, the lines assembled into paragraphs, and so on. These two engineers created machines that assembled matrices in their correct order, then cast new type for printing. The type was always fresh, and it was not necessary to distribute the type after printing; it was simply thrown into a melting pot (dubbed a "Hell Box") so the metal could be used repeatedly.

The Linotype, invented by Ottmar Merganthaler, was first installed at the New York Tribune office in 1886. The Linotype cast all of the characters for a line of type on a single type body. As the operator operated a keyboard, a matrix for each character fell into a single line. When the line was full of matrices the "line o' type" was then cast as a solid slug (single piece). If a correction needed to be made, the entire slug was recast.

At about the same time, Tolbert Lanston developed the Monotype machine, which consisted of two parts, keyboard and castor. The keyboard operator produced a punch paper tape which was used to drive the castor, which cast individual characters. If a line of type contained a bad character, only that character need be recast.

Both the Linotype and Monotype machines restricted the design of type. Whereas, before, punch cutters could create characters of any width, the modern machines required that character widths be set to one of only a few widths. Some type designs required slight modification of their decender length in order to accommodate the restrictions of the equipment. As you would expect, both machines, but particularly the Linotype, needed a great number of matrices (to cast their characters). Prior to the advent of the "lino" and "mono," typecutters had been able to keep up with the demand for their punches.

The new machines meant that demand would escalate dramatically.

The development of the punch cutting pantograph by Linn Boyd Benton, patented in 1885, solved the problem of hand punch cutting. The pantograph allowed a type matrix to be cut by following a drawing or pattern of the character. No longer could type be cut only by hand. Now anyone who could draw could design type. Designers no longer needed to convey to a punch cutter their intentions for a character's shape and allow the punch cutter to interpret their design.

Unfortunately, the same drawing or pattern could be used to cut matrices for type of almost any size. The practice of cutting a unique punch to scale for each size of type was abandoned. In the process slight variations in letter shape to account for differences in size were lost. [See figure 7.]

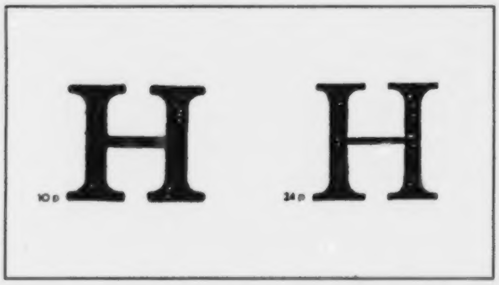


Figure 7: 10 pt and 24 pt type enlarged to the same optical size

The art and craft of the punch cutter came into jeopardy. It was now possible to have type designed by non-specialists who did not possess the artistic talent and craftsman skills of the punch cutter. Two examples of this are Cheltenham, a typeface designed in 1896 by American architect Bertram Goodhue, and Century, designed in 1895 by Theodore DeVinne, a master printer, for "The Century", a magazine. Later variations, including Century Schoolbook, were also designed by DeVinne.

Just as movable type technology spelled the demise of the scribes, typesetting technology outdated the punch cutters. However, as one set of craftsmen's skills pass into extinction, another set of new skills emerge.

The Electronic Era

The electronic era can be characterized as having three distinct generations. The first generation saw the modification of the Linotype machine from a hot metal linecaster into a photographic typesetter. The Merganthaler Company's "Fotosetter" was introduced into the Government Printing Office in 1946. By replacing the melting pot with a photo exposure unit and placing a small negative image of each character into the center of each matrix, the inventors created a machine which could now set photographic characters one at a time. Slow and cumbersome, the machine was nonetheless a turning point in the transition from hot metal typesetting to photographic (cold) typesetting.

In about 1956 the Merganthaler Company introduced a second generation phototypesetter, the Linofilm Quick. Second generation phototypesetting was characterized by equipment designed from scratch for the intended purpose, not simply modified from some past task. Additionally, this equipment gradually became computer directed as opposed to purely mechanical in nature.

Third generation phototypesetting began with the introduction of the RCA Videocomp in 1970. Third generation phototypesetting is electronic and digital in nature. A digitized character is stored in computer memory and imaged onto the surface of a cathode ray tube when directed by the computer. Through a series of lenses the light from the illuminated screen is focused and sized onto photographic paper.

As with the Linotype and Monotype machines of the previous era, phototypesetting did not enjoy the advantages of uniquely designed characters for each size of type to be used. Instead a single version or shape of a character was used (in either photo negative form, or in digital memory) throughout the size range to be set. The advantage was speed! Compared to Gutenberg who was delighted to have set several pages of type in single day, third generation phototypesetting equipment could set hundreds of characters per second and thousands of characters per minute.

Whereas Gutenberg required craft and skill to justify lines of type, electronic era typesetters have relied on their computer programming to direct their actions. Hyphenation, once the provence of the typographer/printer could be left—thanks to electronics— to the hyphenation logic algorithm and the exception word dictionary. Art and craft began a metamorphosis into science and black box technology.

The Desktop Era

Not enough time has passed to write a reflective history of the desktop publishing era. Too much has happened too fast. At this juncture it may be more meaningful to organize our thoughts about what has happened rather than just to say when things occurred. Still, we do know some of the chronology. In the early 1980's adventuresome teachers and hackers had been experimenting with handbills, notices, handouts, and other less than glorious "printed" works. These creations were generated on low resolution dot matrix printers which produced raster images on paper.

Historians may well record that the true beginning of the DTP era was the day that the first copy of Printshop was sold—or the day that Screenwriter or AppleWorks was introduced for the Apple II computer.

We know the precise time when the term "desktop publishing" came into use. On January 28, 1985 the president of Aldus corporation, Paul Brainerd, introduced the term and the concept at an Apple stockholder's meeting. Brainerd was conveying four principal ideas at the time:

1. The most obvious idea was his desktop metaphor—that publishing could be done with equipment small enough to fit upon a desk top.

2. "Publishing" was more than just typing words onto a page. Rather, it involved a total "system" capable of providing as output publishable pages, including graphics.

3. Non-professionals could (would) have control over the publishing process.

4. The system making all of this possible would be inexpensive enough for popular adoption and would be sold in retail outlets (Seybold & Dressler, 1987).

If anything, the concept of what constitutes publishing has expanded since Brainerd turned Desktop Publishing into a household term. Journals for the new breed of desktop publishers (e.g., *PC Publishing, Computer Publishing, Electronic Publishing & Printing, Publish*, and others) are filled with articles on a wide variety of subjects. A truncated outline of topics that would elaborate Brainerd's idea of a desktop system to provide publishable output might look like this:

1. Computer topics
   1.1 Hardware
   1.2 Software
2. Publishing topics
   2.1 Type— size, weight, contrast, stress
   2.2 Typography— usage, fonts, spacing, form and format
   2.3 Layout
      2.3.1 Design considerations
      2.3.2 Text & body copy
      2.3.3 Illustrations
         2.3.3.1 Photographs and Half tones
         2.3.3.2 Line art
      2.3.4 Color
   2.4 Printing

Type Wisdom

Steve Beyers (1991) has stated that "A new source of type wisdom is emerging." His reference was to the field of electronic publishing, and he went on to say, "The result is that typographic expertise is now more available than ever— just from different players." Beyers, a consultant on electronic typography, spent fifteen years working for Linotype— a company that made its fame and fortune in the days of hot lead printing. He is one of the first of those different players, but he no longer would be considered a rarity. Indeed, there are not only an abundance of new players, but new types of players dispensing expertise on sundry facets of typography.

New Players and New Roles

Robin Williams, for example, as a contributing editor for *Desktop Communications* writes a typography column. His columns, which began with the March - April, 1991 issue, are not targeted at typographers but at neophytes. So what kind of advice does he give? The title of his very first column was "A Study in Contrasts." (Williams, 1991) In terms anyone can understand he stated, "There are six distinct ways of contrasting type: by size, weight, structure, form, direction, and color." He then went on in equally understandable terms to explain each of the six contrasting possibilities, and nailed everything down with examples in which the visual contrasts were impossible to miss.

In his second column Williams (1991b) kept it simple, dealing with the jargon of spacing. The subheadings of that article give a sense of what things an expert might choose to talk about to a novice: Kerning, pair kerning, auto pair kerning, manual kerning, tracking or track kerning, letter spacing, and word spacing. Clearly these topics are at the nucleus of typesetting, which is central to all of typography.

At a slightly higher level of technical expertise in the area of typography, we are finding more role shifting and the emergence of many new players in the game of typeface design. John Berry (1991) writes of a renaissance in type design. He associates this "revolution" with the introduction of the postscript-compatible laser printer. Thanks to this revolution, anyone who wants to spend a little more money can actually design his or her own typefaces. Just as you can use type without training in typography (though it helps), you can create your own fonts without any training in either typography or type design. This is what Rene' Kerfnate, director of typography at Monotype, called the "democratization of type design." (Berry, 1991, p.23)

Edward Tufte— whose two books, *Visual Display of Quantitative Information* (Tufte, 1983) and *Envisioning Information* (Tufte, 1991) are destined to be layout-design-display classics— was quoted on this topic by Silverstone (1991). In response to the question, "What is the role of typography in information design?", Tufte replied:

> For 500 years, very smart and talented people have been thinking about type, and we should therefore take the lessons of classical typography. The last ten years have been just glorious times in terms of typography. More people in the world know what small caps are. The computer has made people more sensitive to type. We don't have to be creative anymore as far as type is concerned. Good type is a solved problem. You just look at well-designed books. So, many people now know what kerning means, and letter spacing and so on. Typography has become democratized. (Silverstone, 1991, p.29)

In comparing the two quotations above, we note that the changing (increasing) role of the users of typefaces—as regards creativity—is seen in opposite ways by two individuals who are very close to the field of typography. Tufte holds that more people can now draw upon

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classical typography. Berry envisions beginners being able to create their own fonts.

The Educator's Role: A Special Case

The new technologies which have made desktop publishing possible are widely available in all sectors of society today, but the impact of DTP is not evenly spread. Certainly one element of society that is and will continue to be most affected by DTP is the instructional field. Public schools, trade schools, junior colleges, universities and corporate training programs alike are benefitting from desktop publishing. Perhaps no other segment of society creates so many small run duplicated documents.

Educators, and particularly instructional technologists, have a long standing professional interest in the display of text. They have concerned themselves with how good typographic practice can help the authors and designers of instructional materials. Their interest has extended to the exceptions to otherwise good practice as well as the special instructional publishing conventions and formats. Even before DTP Hartley was suggesting that educators should consider the publishing implications of three alternatives to conventional prose; algorithms, information mapping, and programmed instruction (Hartley, 1978; also 1985, ch.9). Hartley made a connection between educational materials and such common publishing considerations as page size, type sizes, type faces, spacing, space, structure, and the role of illustrations.

While Hartley, Duchastel, and Waller were among the pioneers, it was Jonassen who brought interest and attention to the role of text in instructional design with his two award winning books (1982, 1985). Jonassen's first volume of The Technology of Text (1982), provided a chapter on "Using Typography to Improve Access and Understanding" (Waller, 1982), another chapter on "Design Principles for Diagrams and Charts" (Winn & Holiday, 1982), and a chapter on "Design of Tables and Flowcharts" (Wright, 1982), as well as several other chapters both theoretical and applied. Volume II (Jonassen, 1985) continued in the same vein with new topics of interest such as. "Graphic Organizers in Texts" (Hawk et al, 1985), "Typographical Cues in Text, Management of the Reader's Attention" (Glynn et al, 1985), "Marginalia" (Duchastel, 1985), and "The Role of Headings" (Hartley & Jonassen, 1985). These are merely samples¨intended to demonstrate the type of interest held by instructional technologists in matters related to printing/publishing.

In spite of the obvious direct links between publishing and instruction, Misanchuk (1992) contends that there are fundamental difference between regular DTP and DTPI (Desktop Publishing for Instruction). The salient characteristic that he believes differentiates the two is intent. However, intent influences priorities, and thus the entire approach..

> DTP is generally much more concerned with how a document looks than with what it is that the document is supposed to do, and how well it does it. I believe that educators have a defensible right¨indeed, perhaps an obligation¨to change those priorities around, making aesthetics secondary to instructional considerations.¨ in DTP form precedes function; in DTPI, form follows function (Misanchuk, 1992, p.21).

Gropper (1991) has spoken to the intuitive notion held by legions of educators that the appearance of printed material affects its effectiveness as educational material.

> The way words are organized and displayed can enhance or diminish them. In the analysis offered here, positive or negative effects can be produced either by the way words are deployed on a page or by the look of the page (Gropper, 1991, p.5).

So, how do the special concerns of instructional technologists relate to the general phenomenon of evermore DTP power being made available to a public unschooled in the intricacies of typography, publication design, pre-press, and printing in general? Clearly there is a job-related need for instructional technologists (and perhaps other professionals outside of the printing field) to become highly skilled at using DTP technologies, Although technology makes it easier for us to do things (e.g., DTP), we may not have easier things to do. Instructional technologists will find that, "When you, the educator, take on DTP, you are essentially taking on the roles of a number of highly trained people with varying functions... author... editor... sub-editor... designer... typographer/compositor... illustrator and photographer... layout artist... expert reader... and proofreader." (Misanchuk, 1992)

In other words, instructional technologists and probably others will find themselves caught in a semi-expert category between the positions of generalist and specialist. They will be both unlike the church secretary who needs only the skill to publish a congregational newsletter, and unlike the professional publisher who needs to know everything there is to know about the printing business. As semi-experts with intermediate skills, these generalized specialists will create a demand for high powered software with expert system characteristics. They will want easy to learn programs that minimize DTP decision making. However, no amount of sophistication in the application of boilerplate, style sheets, and typographical setup/layout assistance will eliminate the requirement that the semi-experts be highly knowledgeable about current publication vocabulary, theory, and practice.

Product Journals

An expanding role for individuals with expertise is through consultation. Because many desktop publishers cannot afford personal on-site consultation at a distance is a growing industry. Users of sophisticated computer software for publishing quickly learn that expert advice is available via the technical assistance "hotline." What the software manufactures are doing is hiring expert users of their software to advise not-so-expert users over a telephone line.

The second method for distant location advising is via publications which carry articles and features that unlock the secrets of software use. These specialty journals (e.g., *Aldus Magazine*, *Ventura Publishes*, *WordPerfect the Magazine*, and many more) provide ips and tricks for professionals and beginners alike. They also provide a link between typographical tradition and seemingly unrestrained innovation.

Conclusions

Craftsmanship

No longer is craftsmanship in publishing the exclusive purview of the graphic artist or the graphic designer. The average DTP person has invested time and energy to become familiar with an amazing breadth of new and sometimes bewildering information. Vocabulary, font usage, drawing of illustrations, and even the creation of suitable halftone images are all being accomplished, and sometimes even mastered by individuals who are new to DTP.

For the professional, no longer is an understanding of design or graphic arts enough to survive— the professional needs to understand how hardware and software interact with design and production of publications. The "new guild" of typographers, designers, and graphic artists is an "electronic guild." Bits, bytes, RAM, ROM, TIFF, PCX— all of these terms now have as much meaning as does the traditional vocabulary of publishing— terms such as point, pica, agate, leading, font, and series.

While it is true that the emergence of DTP, and the subsequent evolutionary growth into electronic publishing, has offered greater productivity and an expanded design capability over traditional techniques of publication design, there has been a price to be paid for these benefits. The price is increased complexity and the need to understand a broader spectrum of issues. Remember the "good old days" of typing a paper or an exam? Is what you do now really easier or as simple as it used to be? Probably not. But we all enjoy the benefits of a spell checker and use of style sheets— and we take advantage of these things to make our documents look better than they ever looked before. But the task is more complex, if not more difficult. We now worry about format, and all that implies. We expend greater effort, and get a superior product because the tools now available allow us to do so.

Things will never again be as clear or as simple as they were in the fifteenth century when publishing was in its infancy. Now we have a wide spectrum of skilled technicians rather than a few kinds of skilled craftsmen. Today's technicians are, indeed, the craftsmen of this and the next century. What most distinguishes the modern experts is that there are so many species of them, and that for each kind of expert there is a varied marketplace. Consequently, we find practitioners doing the same kinds of craft (technical) activities at various levels of difficulty. The range goes all of the way from the beginning do-it-yourselfer, through semi-expert and practicing technician to fully-expert consultant.

Visual Style

Creativity with respect to design and visual style now has tools available that were not even imagined 10 years ago. Corel Draw, Arts and Letters— the list of available software for font creation and manipulation grows each month. With each new version of this type of software the opportunities for new growth is certain. DTP has evolved from type, to page design, to illustration and drawing, to finally the newest area of software and hardware development— color.

Aesthetics

Will a new aesthetic be created by the readily available opportunity to create such an aesthetic? Never before has new design been easier to attempt. Image manipulation (type, blends, colors, etc.) is so accessible that a variety of new techniques are being explored by everyone who sits in front of computer. It is reasonable to assume that some of the things that are new (visually) will become commonplace and accepted.

Mystique

The mystery is not gone from publication, but it is certainly diminished. Public awareness of publishing terms and techniques has never been greater— and it seems to be continuing to expand. But will the average desktop publisher want to tackle the really tough issues, such as color separation? Probably not until the software is mature enough to make that task less challenging.

The Future

Where do we go from here? Faster and faster forward. The DTP evolution will allow individuals to create documents with greater sophistication and perhaps increased visual impact. Increased use of style sheets and templates will allow almost everyone to create documents that, while not "new design," will be polished and more closely resemble the efforts of a professional. For the professional, separate tasks merge into one. Eventually it is possible that almost all of the "pre-press" functions of publication work will be performed by a single piece of "mega software," which combines all DTP functions (word processing, page design, bit mapped and vector drawing, color separation, photo retouching and halftoning, etc.).

Illustration credits:

Figure 2. detail of illustration on page 13, *The Art of Lettering*, by Albert Kapr. Munich: K.G. Saur, 1983.

Figure 4. illustration on page 33, *Letters of Credit*, by Walter Tracy. Boston: David R. Godine Publisher, 1986.

Figure 7. detail of illustration on page 78, *The Thames and Hudson Manual of Typography*, by Ruari McLean. London: Thames and Hudson, Ltd., 1980.

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Pixels Instead of Pens and Paste

John Belland
Tim Best

Social Construction of Understanding
THEORY
Practice

In an attempt to infuse the world of practice with new thinking from the world of theory, we have set out to create a culture of learning in which passion and expertise are modeled for learners, who in turn are nurtured and supported in uncritical ways. A new paradigm of formal learning is created which challenges the basic assumptions that most experienced teachers believe and have experienced as students and as teachers.

THEORY

Social Construction of Understanding. Our understanding of the world and our relationship to it are built through interaction with others. We are surrounded by cultures (networks of understandings) that we have created through consensus with those who share them with us. Some of these cultures are very broad, defined by our national, ethnic, or other similar affiliations; within these broad cultures are smaller ones, defined by our connections with family, friends, work, and other affinity groups. We may take part in more than one culture at any of these different levels (as when we have more than one distinct group of friends, or have multiple work environments). We feel ourselves to be more fully a part of a culture if its values are akin to our own and if we have the opportunity to contribute to its evolution.

In order for true social construction of understanding to take place, there must be open-endedness both in what is to be learned, and in how it is to be learned. If individuals are to participate authentically in the development of new understandings, the content of those understandings cannot be predetermined. And if the way learning is to take place is prescribed, learners will not be able to participate fully in the process of learning.

Practice

[Background.] *It is likely that every college and university which prepares teachers has had a course which deals with local production of instructional materials. Jerry Kemp and Harvey Fry were probably the two most notable "gurus" related to these courses. They trained many graduate students to teach such courses at San Jose State and Indiana University and wrote the most commonly used text books to support such courses. Many teacher-production courses are still taught in the traditional way using traditional techniques and materials. At the Ohio State University, however, the course ED P&L 676, Preparation of Teacher-Made Instructional Materials had passed into "limbo," a term used by the registrar for courses which had not been taught for the past five years. This was due not to lack of interest but rather to the lack of available faculty.*

It occurred to us that contemporary desk-top publishing technology might be a way to transform the OSU course into

a more powerful and practical set of ideas and skills for teachers.

Modeling/Embodying. One way of learning is by using others as models. We do this most directly when we observe others in order to imitate their behavior–that is, when what we are learning is new behavior, and we are learning by observing someone else doing that behavior. The people we accept as models typically embody values that are already important to us. Once we have accepted someone as a model, he or she will play a role in determining the new values we develop.

Because people learn new behavior from their models, they should be exposed to people who are models of excellence in an activity. Typically, such people also exhibit positive values and attitudes with respect to the activity, such as passion and enthusiasm, which are also important for learners to be exposed to. Other positive values and attitudes include the desire to learn, openness to different perspectives, self-confidence, and the ability to use critical judgment in assessment. These characteristics, when internalized by a learner, provide a strong foundation for learning.

Modeling is especially important for those who are strong in the interpersonal intelligences, since it allows them to use these intelligences in learning. Modeling is also one of the ways people most commonly learn once they have left school and joined a work community.

In addition, we believed that we could use this course to begin to

teach by example

our ideas on the future of teaching and learning and the development of visual literacy and sophistication among teachers. Having tried some of the ideas on a small group of graduate students using makeshift facilities, it seemed to be fate that made a newly installed laboratory of Macintosh IIcx® computers with PageMaker© software available to us during a break week in the early summer. (The mathematics department needed the laboratory the rest of the time for their courses using Mathematica©.)

We thought about the kinds of materials which teachers need to design and develop to enhance their own teaching and initially settled on overhead transparencies, posters & signs and booklets. These design projects were to be implemented using PowerPoint© and PageMaker© software. They were to be projects which would be used by the teachers in their teaching and would utilize principles of good visual design. We found that the use of PowerPoint© software inhibited the creative process and decided that PageMaker© allowed for the production of all the projects and simplified learning the technical side of the effort.

Learning in Context

Learning in Context. The importance of embedded learning is central in educational research, and it is in direct opposition to the traditional approach to learning. Context is an intrinsic part of the way learning occurs in the real world, in real life–both is how learning takes place, as well as the problems encountered in it. The ideas of authentic activity and situated cognition both concern ways that learning that takes place in real situations is more valuable for the learner than learning that is abstracted away from the situations it really belongs to. Ambiguity and emerging properties can be positive, but–largely because of pressure in education to come up with the "right" answer–are frequently perceived as threatening rather than exciting. And enactment, which must take place in the real world, is one of the most powerful forms of learning we can engage in.

As the course has evolved, the same basic design projects have been continued, but additional projects have been included—certificates and nametags. The nametags project was added in order to provide some immediate gratification. Class members were able to generate a nametag for him or herself in a very short time. This tag was placed in a holder and worn during class to facilitate instructors and classmates being able to address each other by name. The nametags were personalized mostly by selection of typeface and by the alignment of the type (left, centered, or right).

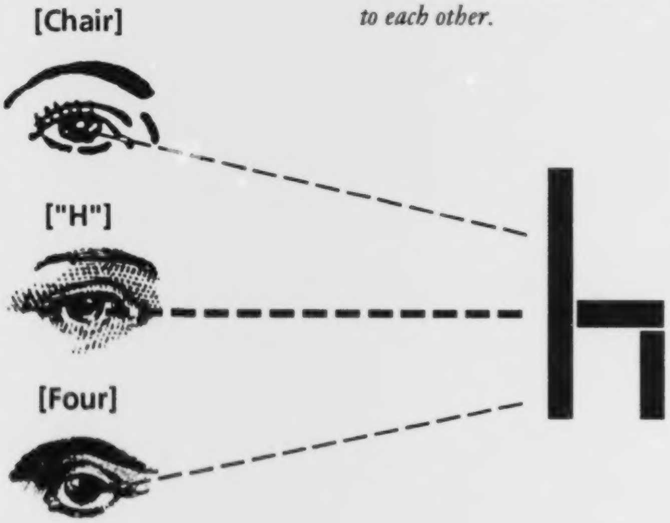
The certificate project provided a means to get quick results as well as to learn about the placement and manipulation of both text and graphics in a format which fit nicely on the computer monitor without scrolling.

Teachers seemed to have needs for certificates of all sorts *and began to share designs with classmates so that each left the class the first day with a set of certificates which they said they would be using "for sure." This experience allowed the classmembers to use simple clip art in addition to creating borders by combining the line and rectangle functions of PageMaker©.*

Collaboration. The ability to collaborate is an important skill in many real world situations. And in education, collaborative activity may also provide a forum in which a wide range of learning strategies can be used. Collaborative activities by their very nature lend themselves to authentic activity, situated cognition, and the socially based learning strategies. They provide exposure to others who may be used as models of effective collaboration, different problem solving strategies, and other new behaviors and perspectives.

Since collaborative design and problem solving are important objectives we have for the course, the certificate project seems, for now, to be a winner.

It probably will seem strange to most teachers that we do not systematically teach the software to the students. Instead, we demonstrate the process of setting up each of the design projects using an LED display projected via an overhead projector. During the demo for the first project, we also demonstrate the basic tools provided in PageMaker©. After this minimalist exposure, we work with individual students as each tries to accomplish a particular, personally-determined task. As class members become proficient in particular techniques, they share their skills and perspectives *with their colleagues. In one of the sessions taught this past summer, two high school students were added as assistants. These students from the Apple Classroom of Tomorrow project at West High School in Columbus were PageMaker© users and were very comfortable teaching teachers 1:1. Interestingly, one of them "taught" one of us some powerful text-manipulation techniques as he roamed about the lab and looked over her shoulder (shades of Margaret Mead's notion of a prefigurative society). It is possible that each teacher in the class knows a different set of PageMaker© techniques at the end of the class. We view this to be a virtue since these teachers can then continue to be a source of support to each other.*



Performance and assessment. Performance and assessment, like students and teachers, have traditionally played complementary roles in education. Students performed, and teachers assessed their performance–usually for the purpose of assigning a grade.

Learners were not taught to think critically about their performance, and were not given the opportunity to improve it.

When students can take responsibility for assessing their own performance, they gain a sense of ownership that motivates them, allowing them to tap into a place of knowing from which they are able to move forward freely and independently.

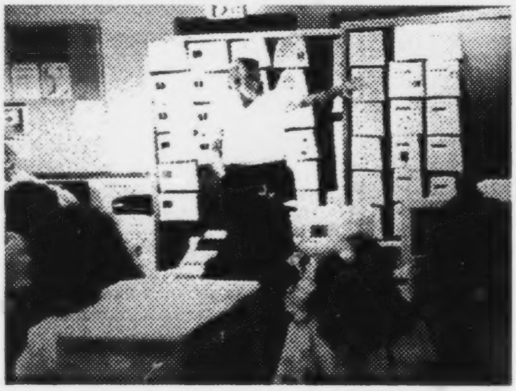
Collecting what is produced in the learning process in a "portfolio" allows students to thoughtfully choose and revise work for presentation, trace the history of its development and exhibit the range of their personal vision and style–all activities that are important parts of real-world performance.

The separation between educators and learners in assessment mirrors the separation between them in the design of educational experience. For learners to perceive education as something of value in their lives, they must contribute to its design.

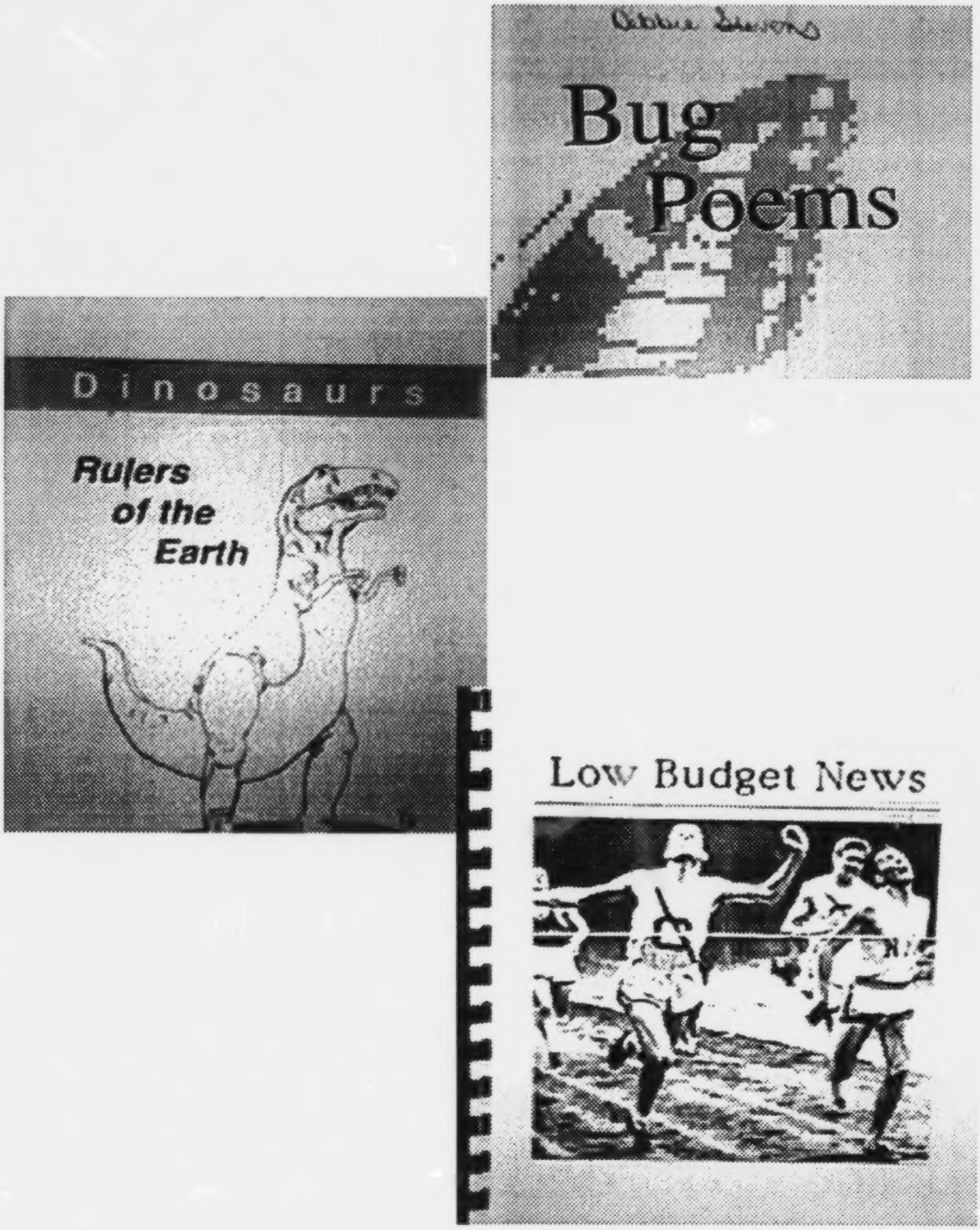
The major focus of the course is on interesting visual design. Thus one of the most important activities is the periodic critiqueing of the work. The first critique involves the critique of the course syllabus. A tradition has developed in which one of us designs a unique syllabus for each offering of the course. As class members loosen up and their critiques become more incisive, they find that we enjoy the interaction and the variety of points-of-view. Then as projects are completed, class members pin the products up to the room dividers for their colleagues to examine. Some time is reserved in each session to critique the work which has been displayed.

Class members then use the critique to revise their product.

By far the most complex of the projects is the booklet/brochure. This project takes about one-third of the total class time. It integrates all the techniques learned in the other projects and adds the criterion of design consistency over the entire piece. Some of these booklets are directed towards the teacher's students. Others are directed towards parents or colleagues. It is striking to observe the excitement which develops as the class members realize that they can produce professional-looking materials.



Examples of the student booklet project incorporating understanding of software and sensitivity to design issue .


Bug
Poems
Dinosaurs
Rulers of the Earth
Low Budget News

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Sign Dictionary Graphics: Graphic Eloquence or Cryptic Paradigm?

Pris Hardin

A Question

Do drawings of American Sign Language (ASL) signs use graphic devices and techniques that viewers understand "at face value"—without the need for special training? Or, are there graphic codes that viewers of these drawings must know in order to produce the ASL signs depicted? If meaningful renderings of ASL signs require knowledge of a graphic language above and beyond the kinetic/visual form of ASL, then some accommodation should be made for naive "readers" attempting to learn ASL signs from drawings. This paper invites signers and designers to examine the interface between sign literacy and graphic literacy to enhance ASL communication.

A Project

When asked to render illustrations of signers for a religious education curriculum, I encountered a morass of conflicting information and commercial pressure that left behind more questions than answers.

The publisher wanted art work, rendered quickly and clearly on the computer. The editor was looking for a sub-contractor with established skills in rendering line art on the computer. Knowledge of American Sign Language on the part of the computer artist did not appear to be important to the publisher!

The curriculum called for children at each elementary grade level to learn ASL signs to accompany one or two songs while they sang. My computer-generated drawings were to provide non-signing teachers with enough information and visual aids to teach the signs. The publisher specified that the drawings for each song were to depict a child of the selected grade level as the signer. Throughout the curriculum project the children drawn were to represent a mix of genders and a cross-section of racial backgrounds.

The Process

Although I knew no ASL, I was eager to participate in the project. Ultimately, the publisher agreed to provide graphic information about the required ASL signs. I would render the desired drawings of child signers in the short time and on the tight budget prescribed by the publisher.

Adobe Illustrator™ and a Macintosh™ computer offered relatively easy solutions to the computer-rendering problems. The publisher sent drawings of the signs needed and I rendered child signers of the requested ages and races—about half of the signers were boys and half were girls.

The Puzzles

My interest in cross-cultural communication prompted many questions about the meaning of the signs and about their use in the context of a hearing community trying to master signs to accompany singing. Some of the word definitions for the publisher's drawings seemed to be poor synonyms for the lyrics. Some of the drawings sent by the publishers showed headless bodies performing signs. Would including the heads make the drawings more meaningful to young children? Would facial expressions make the signs more meaningful?

Most troubling of all, I frequently could not figure out the correct sign actions from the publisher's photocopied drawings. Did I lack some insider knowledge about "reading" the arrows, the dotted-line body parts and general orientation of the signers?

I sought out expert assistance. Christine Hake, a friend who regularly signs for church services, became a special consultant to the project. Between us, we worked out a procedure for refining the drawings for naive learners of signs. Starting with the drawing sent by the publisher, I demonstrated for Christine the sign I interpreted the drawing to describe. She then demonstrated the correct form of the sign. My signing, derived from the publisher's drawing, was wrong much of the time. We then consulted two or three sign dictionaries from Christine's library. Among these resources, we could always identify the drawing sent by the publisher. Our final step was to plan modifications to the publisher's drawing to clarify communication for other naive signers. Although partially parallel to established linguistic methodology, our procedure was entirely subjective. But, it revealed the weakness in the assumption that prominent sign dictionaries communicate adequately or consistently to naive learners of signs.

A Question of Visual Literacy

The over-arching question, arising from the experience remains unanswered. Is a graphic literacy required for interpretation of drawings of signs? Do certain types of arrows, action lines, sequence lines and other stylistic devices serve similar functions from drawing to drawing within a publication and, on a wider scale, from artist to artist and publication to publication?

A limited review of literature uncovered a broad range of graphic devices indicating action—arrows and other motion indicators. In addition, I found a variety of solutions to problems of point-of-view, orientation, superimposition, repetition, sequential presentation and scale/size relationships.

To an artist, these devices and strategies are tools of the trade. Their *systematic* use might provide students of American Sign Language with valuable tools for coding information about signs. The absence of systematic use of graphic elements leaves the entry-level learner with ambiguous and conflicting images. Intermediate and advanced signers, who presumably use sign drawings only as a reference, probably have less trouble understanding drawings since they already know much about sign language.

Why Learn Signing From Still-graphics?

Before pursuing the complexity of the issue, we should pose the obvious question, "Why would anyone try to learn ASL from still drawings?" Ideally, the best method of learning ASL is through live interaction, supplemented, if absolutely necessary, with some form of kinetic, mediated instruction. But realistically, there will always be a place for low-cost, printed drawings of signs; they are durable, compact, easily transported, and require no special equipment to view. Theoretically, sighted people of ordinary intelligence can understand them with little previous training. Certainly, if drawings can describe signs effectively, there is no need for ordinary users to try to learn a more abstract method of printed notation (Stokoe 1990).

Identifying Dynamics of Signing That Drawings Must Represent

Several authors have devised analytical approaches to cataloging the types of action that sign drawings must present. Louie J. Fant (1977) offers a simple set of four categories of action sufficient to the current need. He advises students of ASL to give attention to:

a. the shape of the hands,
b. the start and end points of signs,
c. the movement involved, and
d. the orientation of the action to the other hand, the body and to the recipient of the sign message.

How do still graphics depict these four factors? Do naive viewers of sign drawings find Fant's four categories consistently represented through an array of graphic devices with clear and unambiguous meaning? A brief overview reveals the scope of the problem.

Graphic Devices and Sign Action

The following figures show some of the graphic devices applied to Fant's four areas of sign function.

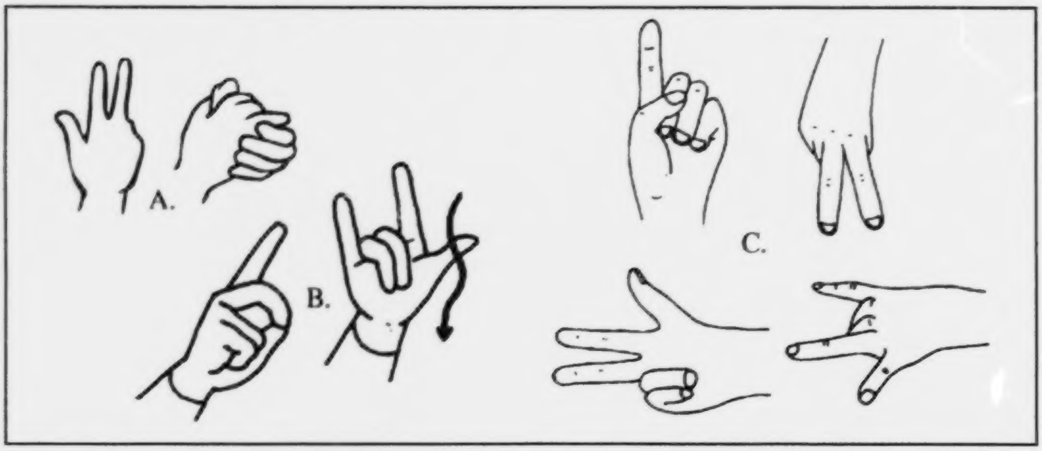
Shape of Hands

Depicting shape of hands seems relatively easy—just show the hands in "freeze frame" style. Drawings showing the shape of hands seem to succeed or fail based upon style and sophistication of rendering and on the angle of each hand presented. The renderings of hands in Figure 1 suggest that even a clumsy, primitive drawing style is acceptable unless some basic anatomical features are badly distorted. Also, angle of presentation may hide from view information needed by the viewer to replicate the sign accurately.

Start- and End-Point Devices

Descriptions of "start and end points" follow a basic strategy—if beginning and ending hands have the same orientation and finger position, only one rendering of the

Figure 1 – Samples of hand-shape drawings, including some with clumsy, anatomically-incorrect rendering. Group A by P. Hardin; Group B from H. Borstein, et al. (1983); Group C from C. Lucas (Ed) (1990); B and C reprinted with permission from the publisher.

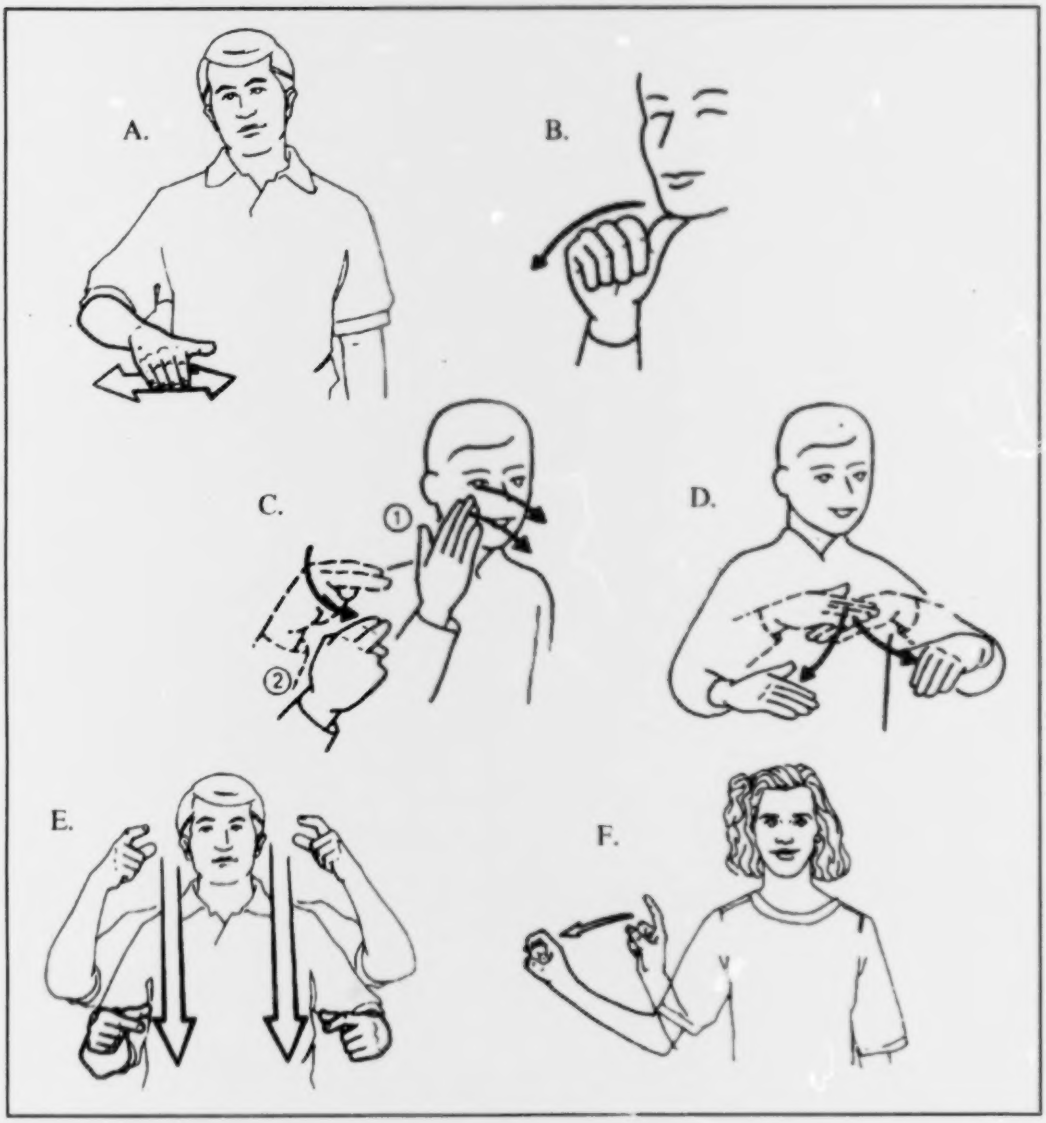


hand(s) and an arrow showing direction will suffice. Any change in finger position or hand orientation demands at least two renderings of the hand(s). Figure 2 presents several graphic devices indicating start point and end point—line weight, dashed lines, multiple drawings and numbered images.

Movement

Fant's third category, movement, serves to convey a wide variety of message content

Figure 2 – Start- and end-point renderings demonstrating a wide range of devices. A and B show only one image of the moving element; arrows show start and end points. C uses repeated renderings with the enhancement of sequential numbers. D represents the most common device—dotted line start-point anatomy and solid-line end-point art. E and F present light/bold line start- and end-point art; F incorporates the additional measure of showing the light (start-point) members as being transparent. A–C from H. Borstein, et al. (1983); D–F from C. Lucas (Ed) (1990). All reprinted with permission from the publisher.



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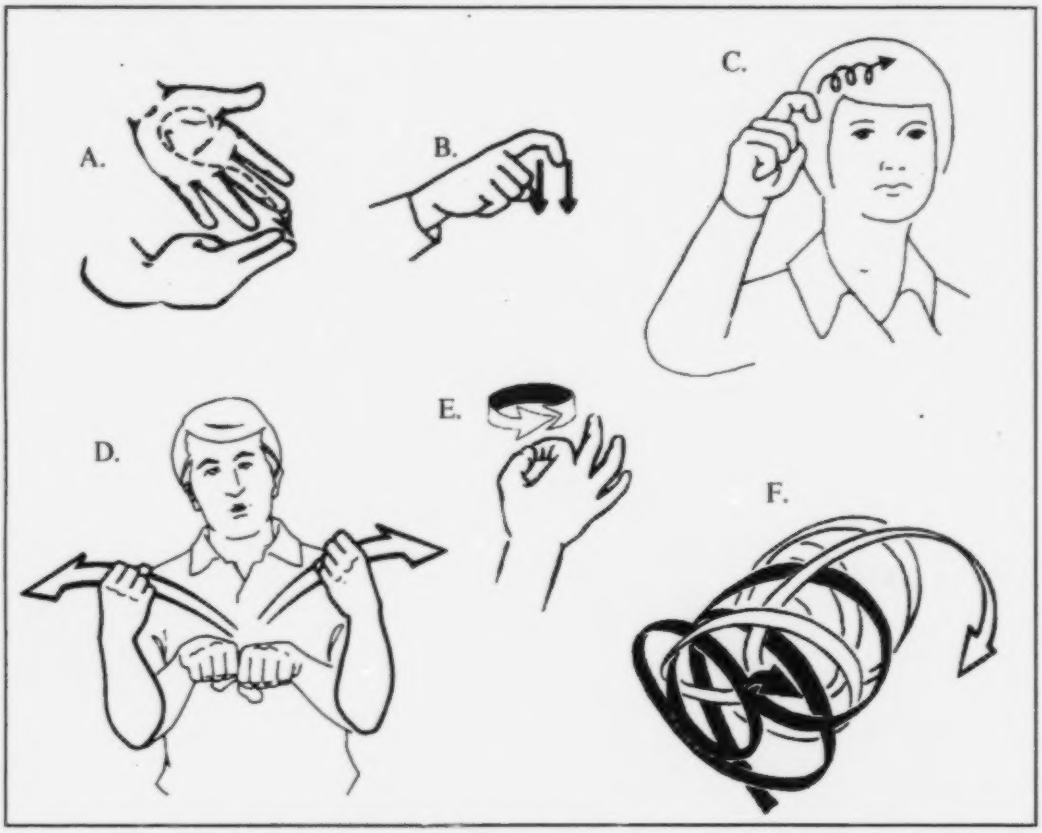
and calls upon the greatest repertoire of graphic devices. Fant calls this the most vital element in signing; variations in movement communicate:

- subject-object relationships,
- quantities (size, plurality/repetition, shape, weight, distance, area),
- physical relationships (meet, follow, look),
- temporal elements, and
- subjective qualities (emotion, difficulty, certainty, intensity).

The great challenge for both producers and readers of sign graphics is to describe motion through static drawings. Artists respond to the challenge with a full array of graphic strategies—variations in line weight, arrows, repetition of drawing components, and cartoon-type notations of path, frequency and impact.

Figure 3 presents arrows as graphic devices indicating motion. The great variety of arrow styles and sizes appearing in current sign dictionaries suggests that artists trust arrows to communicate effectively. Many of the drawings follow varied and conflicting rules of arrow usage, indicating the need for systematic exploration of the rich lexicon of arrows, their current functions and

Figure 3 – A sampling of the wide variety of arrows found in sign graphics. A is a dotted-line arrow indicating a finger track; B and C arrows show straight and curly paths; D and E "ribbon" arrows describe arc and circular moves and F arrows show frenetic action. A and E drawings are by P. Hardin, B and C are from H. Borstein et al. (1983) and D and F are from C. Lucas (Ed.) (1990). All are printed with permission of the publishers.



the potential for more precise and consistent application.

Fant (1977) devised a system of arrows for viewers to learn… much as alpha-numeric notation is learned. Figure 4 shows the six categories of arrows in Fant's system. A review of recently published sign dictionaries suggests that this system did not move into main-stream use. This may be a case in point of Stokoe's warning (1990) against contriving systems of graphic notation that demand learning above and beyond interpretation at face value.

Repetitive rendering of moving anatomy, like time lapse photography, can be either eloquent or cumbersome depending upon the situation. (See Figure 5.) What are the variables? Exploration of repetitive rendering as graphic device may show that it is essential only when there is gradual change in position within the moving member or when the moving member rotates more than

Figure 4 – L. Fant's arrow system serves six types of movement: A arrows cover lateral action parallel to the body, B arrows indicate action like A only vertically, C's perspective arrows describe actions toward or away from the body, D arrows mean repeat the action several times, E arrows call for circular motions by opposing hands and F arrows indicate oscillating motions by opposite hands. After L. Fant (1977); printed by permission of the publisher.

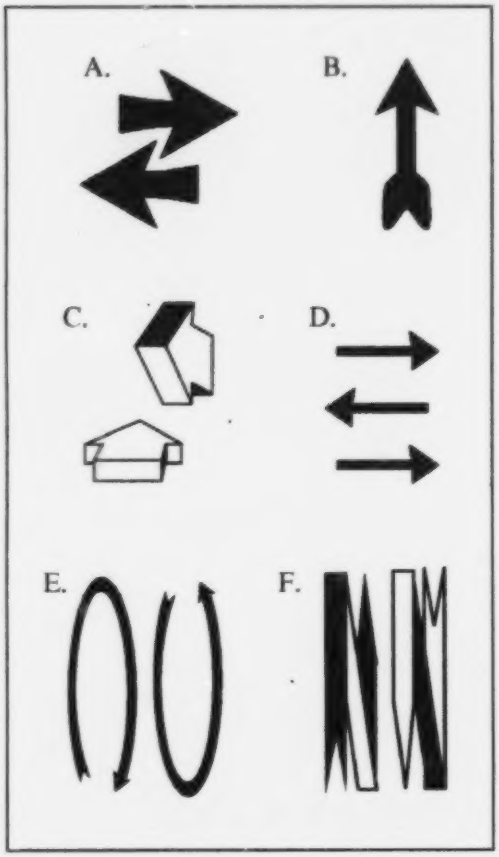
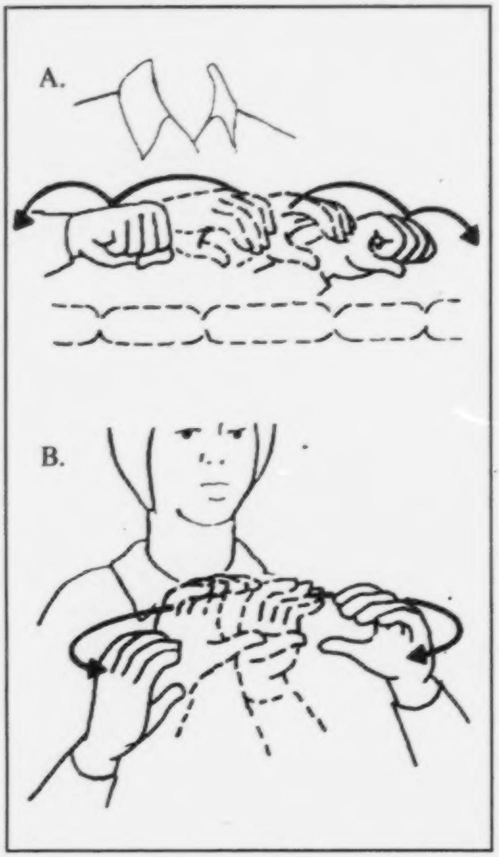


Figure 5 – The two examples below of repetitive drawings to convey motion come from H. Borstein et al. (1983). Drawing A clearly depends upon the second image of each hand to convey the grasping motion describing bologna. In Drawing B, the hands remain the same shape but change orientation. Reprinted with permission of the publisher.

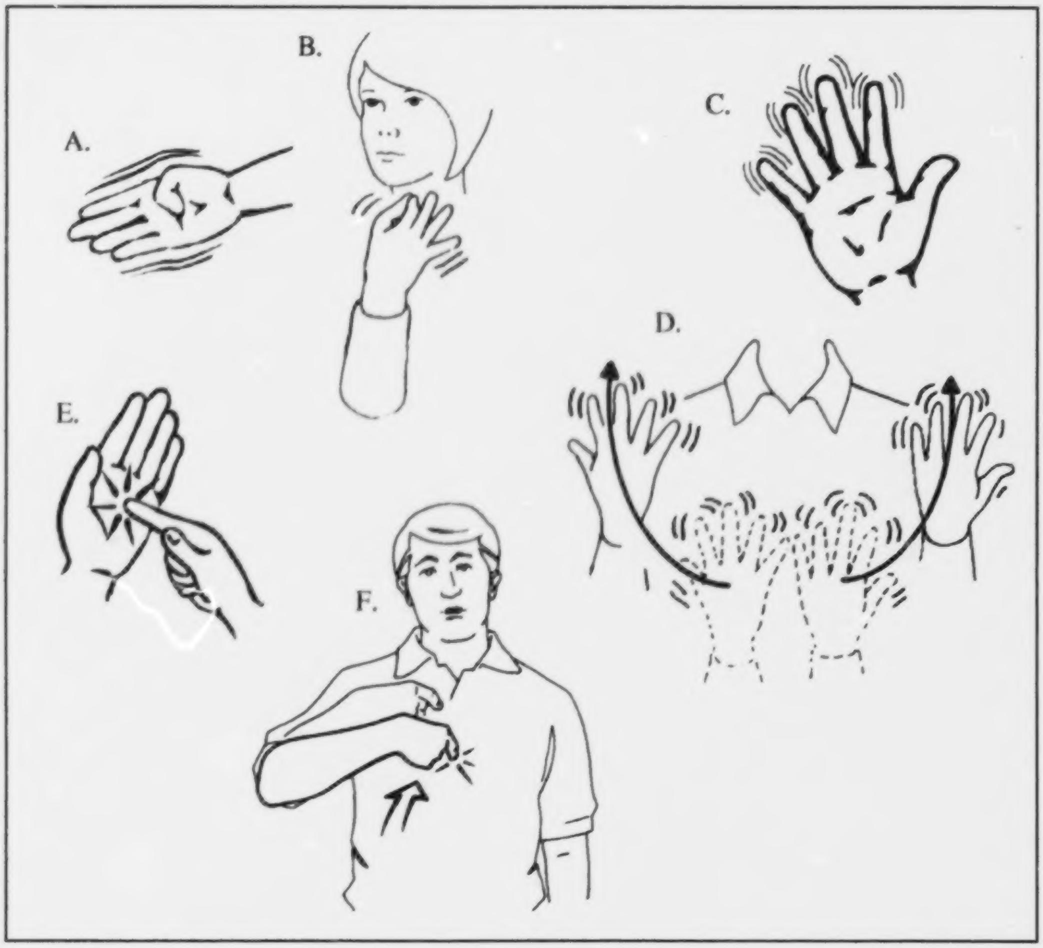


90°. Otherwise, arrows may do the job as simply.

Another rendering device showing motion may be termed "frequency marks." Many frequency marks are simplified, abstract elements of repetitive rendering. The most basic line of the moving anatomy is repeated instead of more detailed drawing of the finger, hand or arm.

Like arrows, some types of frequency marks have become so modified as to approach coded notation. They are completely symbolic and only abstractly related to visual elements found in the natural signing environment. As such, it seems appropriate to label their various manifestations for the purpose of discussion. Figure 6 introduces cartoonists' terminology presented by Bragonier (1981). Although names like "agitrons, digitrons and squeans" are whimsi-

Figure 6 – Drawings A and B show "agitrons"—frequency lines that parallel the outline of the moving member and indicate a quivering or quaking action. Drawings C and D show "digitrons," those familiar little marks from the comic strips describing wiggling fingers or toes. Drawings E and F demonstrate "squeans"—symbolic explosions resulting from momentary touching or contact between two body parts. Drawings A, C & E are by P. Hardin; B and D are from H. Borstein et al. (1983); Drawing F is from C. Lucas (Ed) (1990). All are printed by permission of the publishers.



cal in tone, terms for specific design devices may support better communication among artists, publishers, and signers.

Orientation

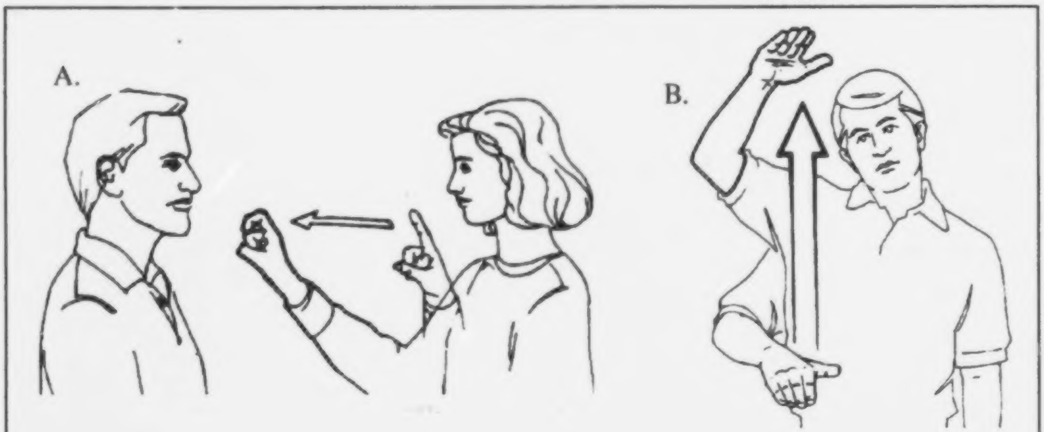
Drawings highlighting Fant's fourth property of signs, orientation, show relationships among a variety of body parts—intra-hand, hand to hand, hand to wrist, hand to body, and hand to sign recipient. Questions of orientation influence artist decisions about how much of the signer the drawing must present, the scale of rendering, point of view and number of sequential drawings needed. Changes of finger position, twists of hand, and wrist action may only demand presentations of hands and forearms. Hand-to-face relationships call for inclusion of head and neck. Sweeping motions involving hand-to-shoulder, hand-to-hip or wide-angle, hand-to-hand relationships generally require whole torso renderings. Figure 7 poses a few questions which artists face in framing up each sign drawing. Guidelines for making scope-of-drawing decisions would assist artists and photographers in identifying "exceptions to the rule."

The role of facial expression, as supplement to changes in even the simplest finger-to-hand orientation is important in many sign conversations. Yet, as artist trying to meet deadlines and budget limitations, I often encountered pressure to exclude facial expression in drawings. Carefully designed research could yield better insights than my intuitive sense that the facial element is an integral part of the sign experience.

Conclusions

Limitations of space and poor responses by publishers in granting copyright releases prevent the current discussion from treating the topic in greater depth. The evidence presented here suggests that further investigation should focus on a systematic analy-

Figure 7 – Every sign drawing must solve questions of orientation regarding overall layout and orientation of sign members within the drawing. Drawing A violates the traditional frontal view of the signer in order to present the sign recipient as well. Other exceptions to the frontal view "rule" appear in Figures 3C and 6B. Two-stage drawings like Figure 2B pose more complicated problems—"If the first stage shows a ¾ view of the head, how is the hands-only second stage oriented?" Drawing B, below, shows another problem faced by sign artists—will naive viewers conclude that the tilt of the head is an essential part of making the sign? Too much information can be as much a communication problem as too little. Both drawings below are from C. Lucas (Ed) (1990) and are printed with permission of the publisher.



sis of the communicative effectiveness of different rendering styles among naive viewers and among intermediate and advanced signers… at the least, variables of age, culture, and learning environment should be included. Such an inquiry would help to establish the need for more precise attention to graphic communication. It might also yield recommendations for systematic use of selected design devices to depict specific elements of signing behavior.

Serious analysis of naive viewers' understanding of still graphic renderings might inform the increasing number of kinetic, mediated dictionaries and instructional packages regarding best angles of presentation, scale and sequence. The growing collection of computer-rendered "body parts"— hands, faces, torsos, etc.— resulting from my sign-illustration project and others like it could be validated for effectiveness and made available to other computer users for combination and recombination. Ultimately such a collection might serve as an "understood-at-face-value" graphic substitute for coded notation on sign communication.

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Learner Characteristics, Information Types, Instructional Strategies, and Diagrams

Diana Buttolph
Rob Branch

The purpose of instructional design is to create instruction. Such genesis occurs by organizing the conditions of learning in a predetermined sequence of events that achieve specified learner outcomes. Brody (1984) has noted that the effects of graphics on instruction are of primary concern to instructional technologists because of technologists' focus on finding solutions to instructional problems, and methods to increase the effectiveness and efficiency of instruction. Branch (1991) has concluded that diagrams, as a study aid, enhance the potential for learner comprehension. The ability to distinguish differences between diagram types, based on visual elements, graphic attributes, and the potential contribution to the learning experience, is important from the perspective of instructional design. Instructional designers routinely consider the variables of the instructional episode: the learner, the content, the media, the teacher function, and the context within which these variables interact (Figure 1).

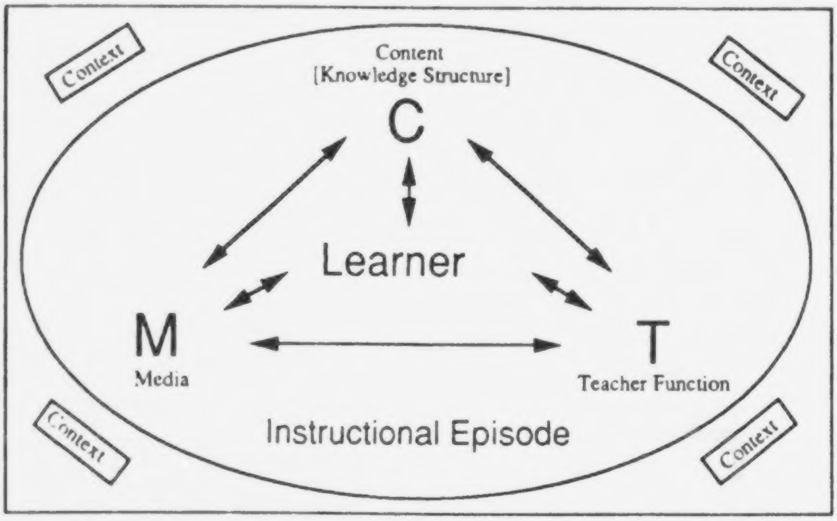


Figure 1. Complexities of Instruction.

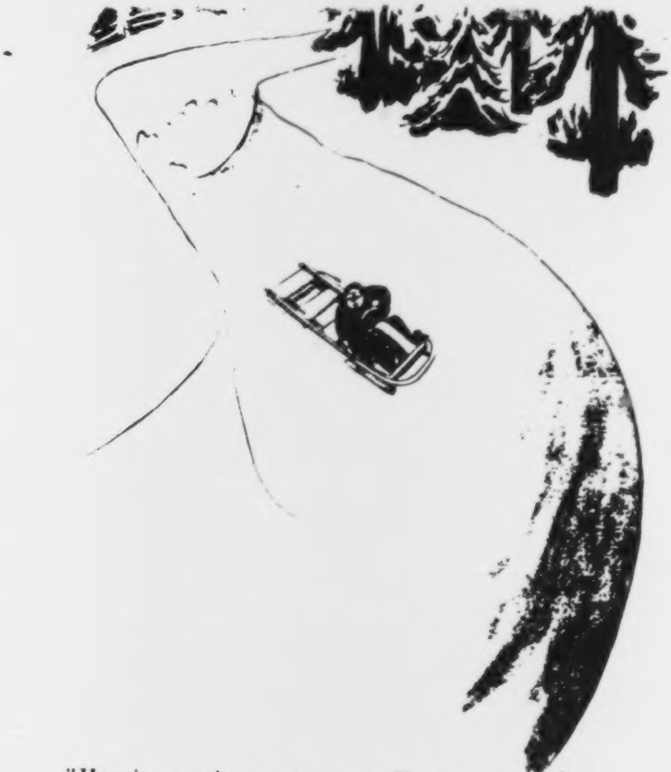
Current information about the use of pictures, diagrams, and other instructional graphics in instruction, and their utility during the learning process reveals that the literature is divided into rather distinct domains of diagrammatic presentations; however, four categories emerge: (1) learner characteristics; (2) information types; (3) instructional strategies; and (4) diagram characteristics. This categorization of research is particularly useful in developing the fundamental components of the systems approach to the design of instruction.

The cartoon in Figure 2 demonstrates several of the assumptions made by an instructional designer who presents it to an audience. These assumptions include those concerning the intended audience, the type of information presented, the cartoon's appropriateness as a component of the instructional strategy, and the characteristics of diagrams.

One assumes the learner is old enough to make sense of the cartoon, that the cartoon is accessible to both men and women, to learners with different cultural backgrounds, and that the learner can read. These elements can be categorized as *learner characteristics.* Learner characteristics include ways in which the interaction of diagram attributes facilitates or inhibits learning from diagrams depending on cognitive style, learning ability, motivation and other affective factors, and the role of prior knowledge and experience.

If this were a presentation about bobsledding, the instructional designer would be assuming that this cartoon is appropriate for illustrating procedure (how to steer through a turn), facts (safety tips for keeping the team on the sled), or concepts (mathematical arcs and angles for

Figure 2. Cartoon as a type of diagram.



"Here's another one, men. Hang on!"

(1958). The New Yorker Album of Sports and Games. New York, NY: Harper & Brothers.

approaching a turn). These are examples of *information types:* aspects of discrete knowledge structures that influence the decision to present the information visually and the selection of diagram type.

The instructional designer assumes that the choice of cartoons in general, and this cartoon in particular, will have the desired effect on student learning. The cartoon probably wouldn't result in rote memorization of bobsledding procedure, nor would it facilitate long-term transfer of training to actual bobsled handling. However, presenting learners with this diagram is better for their understanding than having them draw one themselves. Such assumptions are made according to *instructional strategies*. Instructional strategies include the selection and sequencing of diagrams, the use of visual analogies and symbolism, and generative learning experiences such as learner-generated diagrams and mental imagery.

A further assumption is that the lack of color is not distracting. The pine trees are not green, the snow is not ecru, the bobsled is not brown, yet the learners recognize these elements as they are depicted. It is also assumed that the amount of detail, or lack of it, is appropriate for the learners' understanding, and that the drawing or stylistic conventions of cartoon construction coincide with those that have come to be considered accepted practice in the cartoon industry. Contextual issues are also manifested through the use of cartoons (Hunter, 1989). These are all examples of *diagram characteristics.* Diagram characteristics include the salient attributes of a diagram and types of diagram. Each of these will now be considered in greater depth.

Learner Characteristics

Learner characteristics are arguably the most important when considering the use of instructional diagrams. Pictures and learning have been studied using sixth-graders (Levin & Kaplan, 1972), high school students (Anderson & Kulhavy, 1972), college students (Rigney & Lutz, 1976; Ketcham & Heath, 1962), and adult learners (Alesandrini, 1984; Anglin, 1986; Hansen, 1989). Gender differences have been studied less frequently (Tisher, 1987; Guri-Rozenblit, 1988; Branch, 1991), while socioeconomic status has received scant attention although many studies are careful to include subjects from rural, suburban, and inner city schools.

Learner characteristics are influenced by level of intelligence, level of literacy, level of cognitive development, amount of prior knowledge, cognitive learning style, and ability. Wheeler & Hill (1990) found that problems in comprehension occur when the diagram doesn't match the learner's prior knowledge, or when a learner lacks sufficient prior knowledge to allow a frame of reference in which to place the diagram. Cognitive development is somewhat dependent on age. Greene (1989) discovered that children as young as seven years old were able to understand hierarchical relations when expressed in the form of tree diagrams.

The emotional development of learners has a significant impact on learning from diagrams. The motivational aspect of instructional diagrams is well documented with pictures being preferred by children (Fleming, 1967, 1979; Roth, 1990; Samuels, 1970), as well as adults (Levie & Lentz, 1982). Affective factors that influence the success of diagrams in pre-calculus were discovered by Simon (1986).

Information Types

Information can best be described by content type: facts, concepts, principles, and procedures (Merrill, 1983). Winn (1988) chose to study concepts presented in mechanical diagrams. Simple recall and recognition have been studied using text and text plus pictures comparisons (Ruch & Levin, 1977; Levin, Bender, & Lesgold, 1976; Lesgold, Shimron, Levin, & Guttman, 1975). Samuels (1970) tested for comprehension using a combination of pictures and printed text, while Van Patten, Chao, & Reigeluth (1986) outlined strategies for synthesizing information using concept mapping. Mayer (1989a) and Szlichcinski (1979) outlined the need for creative problem solving and discussed instructional as well as diagram design strategies for fostering this type of learning.

Instructional Strategy

Instructional strategies depend partly on the type of learning desired, such as straight comprehension, application of skills or concepts, and analysis or synthesis of information; and the instructional approach to learning, which is either teacher-generated or learner-generated. Teacher-generated instructional strategies take the form of advance organizers, graphic organizers, sequencing of information, analogies, and symbolism. Unlike most advance organizers, graphic organizers are visual and provide prefatory information to students. Graphic organizers include flow charts, tree diagrams, Venn diagrams, concept maps, and matrices; and are used when referring to "a cognitive map in which important aspects of a concept, topic, or unit of study are identified and arranged in a visual pattern with appropriate verbal labels" (Cassidy, 1989, p.34). Socrates drew a graphic organizer in the sand, seen below in Figure 3, when explaining to a student how to get an 8 square foot square from a 16 square foot square, using simple geometry.

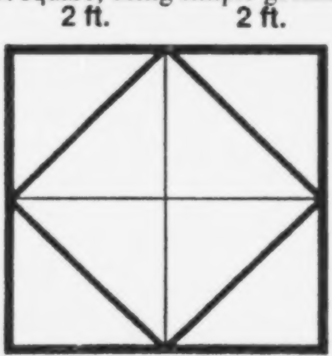


Figure 3. Socrates' 8 ft. square within a 16 ft. square.

Visual analogies differ from verbal analogies in that they relate directly to the objects they represent, for example, a Macintosh folder icon (Smith, 1989; Lindstromberg, 1989). Visual analogies, like graphic organizers, may be presented before instruction as a means of helping students organize and remember subsequent instruction (Levie & Lentz, 1982).

Learner-generated strategies are those methods that learners use to assist themselves in learning. An example can be found in a study by Leahy (1989) of concept mapping in a literature class. Students who drew their own maps engaged in a process of manipulating the concepts in the literature, thought more about what they were reading, and were able to share their thoughts articulately with other students. Examples of learner-generated instructional strategies are diagram construction in the form of concept mapping, photo essays, and storyboard or collage making; and the use of mental imagery. Photographs and storyboards were used by students in a multi-cultural classroom as a means to express knowledge and meaning in a systematic way (Sinatra, Beaudry, Stahl-Gemake, and Guastello, 1990). Levin & Kaplan, 1972; James & Tech, 1989; Anderson & Kulhavy, 1972 have provided promising evidence that mental imagery facilitates recall.

Diagram Characteristics

Visual qualities of diagrams include such physical attributes as diagram size, use of perspective and proportion, and use of color. Also in this category are functional attributes such as diagram complexity, i.e. the number of separate elements, the number of relationships depicted, the amount of detail, level of abstraction, grouping of elements, and the sequencing of elements. These also contribute to diagram integrity which is determined by examining whether procedures or concepts are depicted correctly; whether the meaning is clear or concepts can be successfully extrapolated from the elements; and whether the diagram is complete.

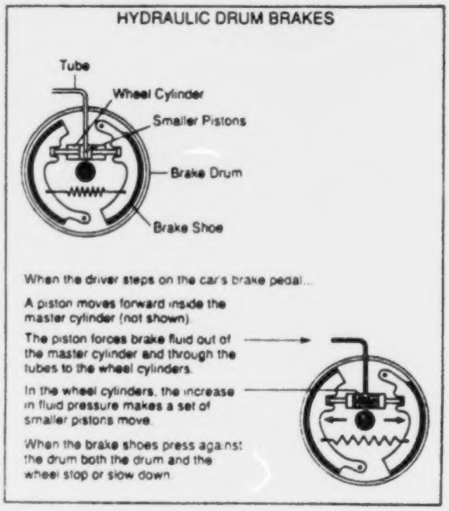
The study by Moynihan and Mukherjee (1981) tested both physical and functional diagram characteristics with non-literate populations. Using drawings, they discovered that size, color, perspective and complexity play a major role in the ability of the subjects to understand the pictures. For example, small scaled-down drawings could only be understood when the pictures were very simple (p. 255-6). Color, they found, had cultural associations that interfered with picture comprehension. Three-dimensional drawings were not always understood, and the amount of detail provided often served to distract the subjects from the important parts of the picture (p. 255).

Additional research of the physical characteristics includes studies of the number of picture elements and the level of abstraction (Winn & Sutherland, 1989); the integration of elements into a structural coherence (Spangenberg, 1971); and a comparison of learning through pictures versus through partial pictures (Guttmann, Levin, & Pressley, 1977). It is further noted by Fleming (1979) that the number of relationships depicted, the grouping and sequencing of visual elements, and the depiction of motion are characteristics that may influence comprehension.

Functional difficulty was discovered by Wheeler & Hill (1990) in their study of the misinterpretation of scientific diagrams. They found that the correct depiction of a particular procedure or concept, the completeness of the depiction, and the clearness with which the meaning may be comprehended from the diagram, are crucial to the understanding of the diagram by learners.

Diagram characteristics commonly include the type of diagram as well as visual qualities. Types of diagrams include graphs and charts such as the pie chart, bar graph, and scatter plot. Described as "non-picture visuals" by Cripwell (1988), graphs have been shown to improve learning as long as the graphs are related to the text they supplement (Noonan, 1990), the graphic format is familiar to the learner (Bogert, 1989), and the elements within the graph are clearly labeled (Griffin, 1989).

Instructional graphics are perhaps the most common type of diagram. Life cycle diagrams, mechanical diagrams, and scientific diagrams have received attention as alternatives to textual information presentation. Moynihan and Mukherjee's (1981) study of life-cycle diagrams revealed that the use of these diagrams in third world countries posed significant problems among non-literates. Mechanical diagrams, such as the hydraulic drum brake diagram discussed by Mayer (1989b) as shown below in Figure 4, contain more verbal information than the life cycle diagrams and often accompany or appear in instructional text. Scientific diagrams explain rather than represent information (Branch, 1991).



When the driver steps on the car's brake pedal...

A piston moves forward inside the master cylinder (not shown).

The piston forces brake fluid out of the master cylinder and through the tubes to the wheel cylinders.

In the wheel cylinders, the increase in fluid pressure makes a set of smaller pistons move.

When the brake shoes press against the drum both the drum and the wheel stop or slow down.

Mayer, R. E. (1989). Models for understanding. Review of Educational Research, 59(1), 43-64.

Figure 4. Mechanical diagram.

Illustrations include pictures, photographs, cartoons, and visual cues. Research by Dwyer (1969) and Sinatra et al. (1990) in the use of photographs in instruction revealed that photographs alone do not automatically increase learning; rather, they affect learning when additional factors are present.

Visual cues may be the most simple form of diagram. They are direct representations of concrete objects. An example is the Macintosh icon of a garbage can or a folder. Smith (1989) calls these visual analogies and notes that they are useful when the learner's analogical reasoning is poor, or when the analogy includes a spatial dimension.

Conclusion

This paper has focused on the use of instructional diagrams from an instructional designer's perspective. The intention here is to emphasize the importance of the categories in instructional diagram design, as variables that should be considered in order for meaningful learning to occur from instructional diagrams. The literature cited herein is representative of the range of issues involved in instructional design issues generally, and the use of instructional diagrams in instruction; yet it is far from exhaustive.

Some of the most exciting and dramatic ways in which instructional diagrams are being used can be found outside the classroom in the leisure arena. Disneyland has advertised "The Human Body" exhibition, a journey through the bloodstream and internal workings of the body, as an "electrifying sensory experience" complete with auditory and visual stimuli. Computer-generated "virtual reality" centers are becoming vogue, not only as a sensory attraction to the public, but also as a means for professionals such as architects and surgeons to "get inside" a three dimensional structure and manipulate objects. Innovative technology in computerized instructional diagrams is also being tested by the military and industry as a means of training their personnel to operate sophisticated systems.

Returning to the more pedantic exploration of instructional diagram use, instructional designers may develop a new course of research by placing the use of instructional diagrams into a larger, mathemagenic context. Future research could redirect the focus from questions concerning specific instructional diagram materials to questions concerning the learner's interactions with instructional diagrams.

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Mind Mapping for Deaf Adult Literacy

Carol A. Harter

Introduction

When the author attended Adult Education Training Workshop and Literacy for the Deaf and Hard of Hearing Conference at Gallaudet University, Washington D.C. in 1989 she was introduced to mind mapping demonstrated by Nancy Margulies, the author of **Mapping Inner Space: Learning and Teaching Mind Mapping**.

Mind mapping, an imaginative record of information on a piece of an unlined paper, is beneficial for deaf adults with minimal written English because it is a visual, spatial, and conceptual, similiar to American Sign Language (ASL) (Margulies, 1991). Its system is flexible and evolutional because it does not require English grammar; however, it helps to improve writing ideas in English. It provides an easy access to a whole brain's unlimited potentials for developing a logical sequence and detailed organization of a material while encouraging imagination and spontaneity, as Gelb (1988) emphasizes. It enhances creative thoughts and increases memory capacity. Thus, mind mapping gives deaf adult students an opportunity to improve literacy in written English.

Applications

Mind mapping can be introduced to anyone from younger children to older adults. According to Gelb and Margulies (1989), mind mapping has many applications as a tool for communication, planning, and memory. They are:

Communication
Meetings
Active listening
Conflict resolution
Insight
Memos

Planning (Professional and Personal)
Meetings
Presentations
Strategic plan
Brainstorming session
Performance appraisal
Conferences
Budget
Career
Sales call
Projects
Activities
Parties
Debates

Memory

Seminars
Reviews for tests
Conversations
Dreams
Meetings
Reports, books, notes
Speeches
Lectures
Names and faces
Summaries

The Human Brain

Gelb (1988) demonstrates that mind mapping, an alternative to traditional outlining and note taking, helps to access a brain's potential for creativity. Margulies (1991) emphasizes that in the early 1970s Dr. Roger Sperry at the University of California discovered that the two sides of our brain function differently. The right side deals with nonverbal activities such as: rhythm, spatial awareness, whole picture, imagination, creative thinking, daydreaming, color, and dimension. It helps the mind create ideas freely. The left side deals with logic, words, numbers, sequence, linearity, analysis, problem solving, and lists. It encourages order and attention to details. As a result of the research of Dr. Sperry and his colleagues, Tony Buzan, a British author and brain researcher, invented mind mapping in 1970. Consequently, practical and productive mind mapping activates the whole-brain relationship that utilizes both the right side for images and the left side for words together.

The Definition of Mind Mapping

Mind mapping is a visual and practical tool that generates and records ideas and thoughts creatively using a key word in the center and one printed word per line before branching out onto a piece of unlined paper. It replaces sentences used in traditional outline and note taking. Colors, codes, and symbols or pictures are also used for emphasis on unlined paper. More importantly, colors, images, and key words are the essential ingredients of mind mapping that make it easier to remember and memorize. Thus, mind mapping is a simple system that enhances creative thinking and increases memory.

The Advantages of Mind Mapping

There are advantages of mind mapping in comparison to traditional outlining and note taking. They are:

Mind Mapping	versus	**Standard Notes**
Whole-brained		Half brain (left side only)
Unlimited potential		Limited potential
Memorable		Memorize facts
Non-linear		Linear
Productive		Low productive
Recallable		Less recallable
Organizable		Mentally disorganized
Thinkable		Slow thinking
Logically sequenced		Sequential (from A to B,etc.)
More creative		Less creative
Clean and clear		Messy and confused
Fast		Slow
Spontaneous		Deliberate
Flexible		Firm
Photographic		Lined
Feedback immediate		Questionable
FUN		FRUSTRATING

The Technique of Mind Mapping

Since the technique of mind mapping was very new to the deaf adult students in the Adult Basic Education (ABE) class under Programs in Adult and Continuing Education (PACE) in the College for Continuing Education at Gallaudet University in the spring 1991, she had to coach them to encourage creativity and thinking skills. With the technique of mind mapping they learned a new skill to improve and expand their thinking skills and to enhance creativity. Then they transformed the mind maps of the unlined papers into written English focusing on written expression instead of grammatical structures. The students had an opportunity to share their mind maps in a group discussion for immediate feedback and suggestions. In other words, they demonstrated their perspectives for others during a shared social interaction in the class.

Mind mapping is a simple process; however, it takes practice and patience for retraining the brain to draw ideas from the central images. Buzan (1991) and Gelb (1988) provide seven guidelines for effective Mind Mapping. There are:

1. **Start mind map by drawing a picture of a theme including a word or two as an option in the center of a paper.** Themes are for generating creative associations. They are easier to remember than words (See Figure 1).

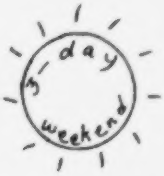

Figure 1. Central Image

2. **Use key words.** They are for recall and creative association. They are easier to remember than sentences. The non-key words such as "the," "a," etc. are not to be used. It is important to use mind mapping in one-clock in clockwise rotation for clarity and readability (See Figure 2).

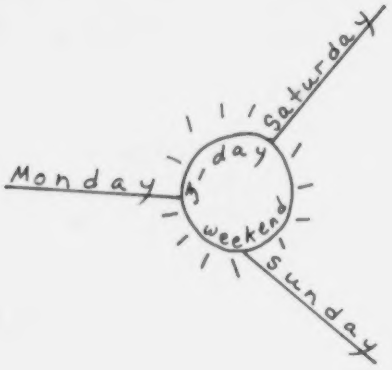
Monday
3-day
weekend
Saturday
Sunday

Figure 2. Key Words

3. **Connect the key words with lines branching out from the central theme.** The linking words with lines are for maximum clarity.

4. **Print key words.** The printed words are easier to read and remember.

5. **Print one key word per line.** This leads to acquiring the maximum number of creative associations for each word (See Figure 3).

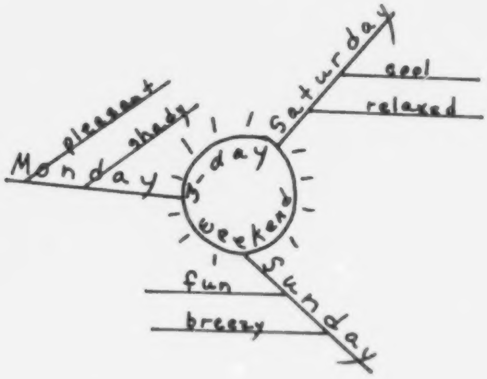
pleasant
shady
Monday
3-day
weekend
Saturday
cool
relaxed
Sunday
fun
breezy

Figure 3. One Per Line

6. **Use colors, pictures and symbols, and codes for emphasis.** Colors and pictures enhance memory while codes show relationship between concepts and function as tools for further organizing map.

7. **Free-associate, then organize.** There are two phases for the process of making mind maps. The free association phase, the first part of the process, is for brainstorming or generating as many ideas as possible. The second part of the process is the organization phase. This phase involves a more analytical perspective with additions of colors, codes, or letters (See Figure 4) .

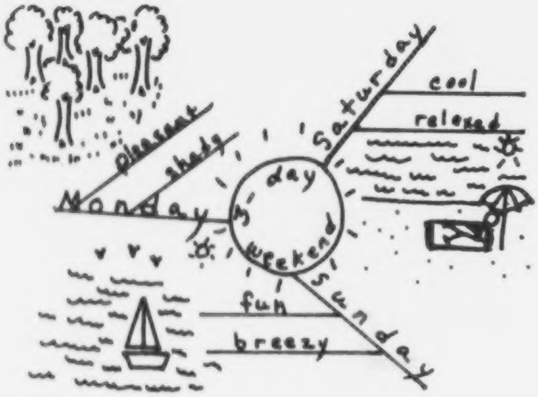

Figure 4. Mind Map

Conclusion

In ABE class the deaf adult students thought that their thinking skills and creativity were limited in expressing themselves in written English due to their lack of vocabulary and grammatical foundation. It was found that mind mapping enhanced their thinking skills and encouraged their creativity. Mind mapping uses the whole brain, the human mind, making it a prominent tool for unlimited creative potential and imaginative ability. Thus, mind mapping is an important visual literacy skill for deaf adult students with minimal written English as well as for deaf children, especially as ASL, their primary language, is highly visual and conceptual.

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MEDIA
and
TECHNOLOGY

Organization of Media to Support Visualization in Medical Education

Kirstin R. Weidanz
Andrew G. Schut
Michael A. Bertolino
Gerald J. Kelliher

Vision is the primary sense that a clinician uses in diagnosis[1]. Thus it follows that a good clinician is one who can correctly interpret, judge, and respond to the visible signs of illness. Since it is so important for health care providers to use their eyes, it is incumbent upon medical educators to teach their students how to be visually literate. Medical educators must not only present their ideas about medicine well, they must familiarize their students with all the visual skills necessary to be a good physician.

Therefore, it follows that in order to train health care providers to use their eyes, medical educators must have access to effective visual media. Medical schools having recognized the need for media services have established departments that specialize in producing visual media. Each of the six medical schools in Philadelphia have departments for creating at least basic audio-visual materials.

In 1981 the Medical College of Pennsylvania (MCP) created the Educational Media Division (EMD) in order to meet the media needs of its faculty. The creation of EMD reflected the trend in medical education to provide better training in visual literacy for health care providers.

Under the direction of the Associate Dean for Medical Education, the Division was reorganized in 1984 (see fig. 1). Over the past decade the role of EMD has catapulted and expanded to include the production of quality educational presentation packages, in addition to offering a vast array of audio-visual support services throughout the institution.

EMD is the core media facility for 405 MCP faculty. Since the Medical College of Pennsylvania is committed to being an active academic institution as well as to providing health care, EMD must produce media services for the divergent needs of its faculty.

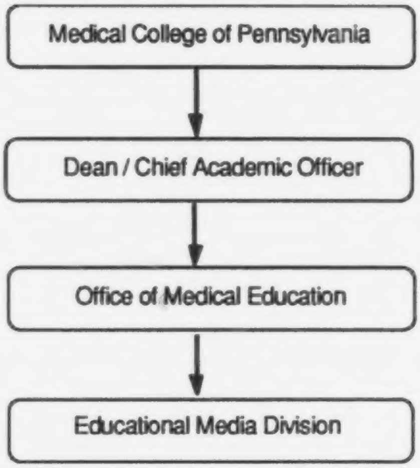

Medical College of Pennsylvania
Dean / Chief Academic Officer
Office of Medical Education
Educational Media Division

Figure 1 Organizational Diagram showing the relationship between the Educational Media Division and the Medical College of Pennsylvania

First, the Division provides media services for both the undergraduate and graduate medical training curricula, resident training programs, and the allied health programs. Because medical education doesn't stop after graduation, EMD is also actively involved in furnishing visual media for continuing medical education.

Medical schools not only teach, they are centers for both basic and applied research. The Medical College of Pennsylvania is a center for a wide range of research. Medical researchers depend on EMD's services in order to:

- Document the results of their experiments
- Communicate their findings to colleagues and students

Clinicians use visual media to document their cases for publication in scientific journals, books, and papers. These visuals can also be incorporated into the various teaching programs at medical institutions.

Hospital administration, including Directors, Department Chairmen, and Deans, utilize services provided by EMD. The division provides a multitude of services from simply lending audio-visual equipment to creating entire media productions.

Over the years, we have come to realize some of the characteristics that have contributed to the overall success of the Educational Media Division at the Medical College of Pennsylvania. They are:

- Client needs' assessment
- Information management system
- Product diversity
- Accessibility
- Cost competitiveness
- Staff development

Our most important accomplishment has been targeting the faculties' visual media needs. We have done mail, telephone, and personal surveys in order to determine the visual media needs of our faculty. These observations are further supported by production data that we collected over the last five years. Later in this paper we will describe an information management system that we have developed to provide decision support for the Division.

EMD is proud of the diversity of products and services offered by the Division. We provide everything from B&W slides to video production. Our complementary consulting service starts the client on the right track. There are three areas in which this service is utilized:

- Creation of presentation packages
- Purchasing of equipment
- Facility development

Presentation consulting consists of helping the client to find the right type of medium that will meet his or her requirements, and that will conform to the correct standards expected of that type of medium. We also confer with the faculty when they are considering the purchase of audio-visual equipment. Through our network of suppliers, we can suggest the most appropriate piece of equipment for any particular application a faculty member might need. Finally, we can apply our knowledge of audio-visual equipment to the development and improvement of our institution's facilities. One example of this was the appointment of an EMD staff member to the facilities planning committee. This committee was responsible for recommending the selection of audio-visual equipment to be purchased for MCP's new auditoriums and Clinical Learning Lab.

Accessibility is also important. EMD is located within the hospital itself. For the convenience of our clients, we provide pick-up and delivery services. Alternatively, those who wish to see us personally are never more than a five minute walk away from the professionals who turn their ideas into visual media.

We strive to make our services cost competitive with other medical schools. We justify our pricing structure by carefully overseeing our production costs and by being constantly aware of what other non-profit institutions are charging for similar services. Our goal is to provide our customers with the best service possible at the minimum price, consistent with effectively running the Division.

EMD encourages its staff to grow both professionally and personally by furthering their education and joining relevant professional organizations. These include the International Visual Literacy Association, Biological Photographic Association, and the International Television Association. These organizations help keep us abreast of the latest developments and techniques in our respective fields.

STRUCTURE OF EMD

Currently, EMD consists of two sections: Electronic Media and Photography. Both provide instructional and consulting services in addition to producing visual media (see fig. 2).

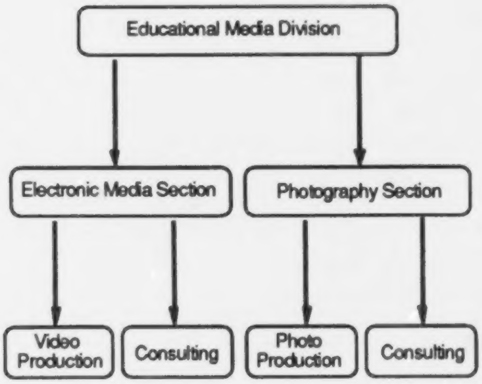


Figure 2 Organizational Structure within the Educational Media Division

The **Electronic Media Section** produces or provides video support for:

- Videotaped Patient Interviews
- Instructional Videotapes
- Lectures, Seminars
- Workshops

Videotaped Patient Interviews

There are basically three types used to support teaching at MCP:

a. **Student and Patient**-Third year medical students must interview a psychiatric patient while being videotaped. The attending physician views the tape and critiques the session with the intention of improving the student's interviewing skills. The videotape not only provides the student with instant feedback on what he or she says, it gives the student the opportunity to analyze his or her posture vis-a-vis the patient. This is important because several studies have shown the importance of body language in the psychotherapeutic process[2-4]. Effective psychotherapy depends not only on what the therapist says but on the message that his or her body language produces. The video gives the instructor a view into the student therapist's office that would be all but impossible without the video camera. Therefore the experienced instructor has the ability to correct and refine the student's technique from both what the instructor *hears* and *sees* of the therapeutic interaction.

b. **Doctor and Patient** - Many doctors/instructors will have EMD videotape themselves interviewing a patient to show students how a proper examination should be conducted. They often contrast this by purposely doing an ineffective interview to emphasize what not to do. The subjects can be either psychiatric or medical patients with routine or rare maladies. Videotape allows the instructor to bring the subject matter alive with real life examples.

c. **Student and Standardized Patient**- Another method used in teaching students how to improve the doctor/patient relationship is the use of standardized patients. A standardized patient is a person trained to simulate a real patient with a certain medical problem. These "patients" are interviewed by the medical students in front of a video camera. The tapes are again used for critique purposes. The instructor uses the tape to improve the students history taking and diagnostic techniques.

Instructional Videotapes

These videos are more structured and planned than the patient interview and can deal with any subject covered in a medical school. EMD works with MCP instructors to script, shoot, and edit the production. We provide the technical and aesthetic guidance to bring the instructor's content and expertise to the screen.
These tapes are used in both classroom teaching and library sign-out. Videotaped lectures are especially advantageous when the talk is either of a highly technical nature or dense in information content. With the videotape, the student has the opportunity to pace the stream of information by pausing and reviewing sections of the tape until the information is fully assimilated.

Some examples of video tapes that we have done are:

"Physical Exam in Sequence"
"Evaluation of the Painful Shoulder"
"Arthroscopic Laser Surgery"
"Epidural Analgesia"

Lectures, Seminars

EMD videotapes lectures and seminars held at the MCP campus and at off-campus locations. These tapes are then made available to faculty members and students who were not able to attend the event. This service is most valuable when a special request speaker lectures or a topic of unique interest is involved.

Workshops

EMD also performs an integral role in the operation of workshops sponsored by the Office of Medical Education. The "Teaching Residents To Teach" program is designed to introduce the MCP resident to teaching techniques, as teaching is an important part of their resident training. On an international level, OME runs a series of "Effective Teaching Workshops" for professionals who want to improve their teaching skills. In both programs, EMD is responsible for audio-visual support and videotaping of all the participant's teaching segments. These taped segments are then critiqued and kept as a record of improvement.

The **Photography Section** provides:

- Medical Photography
- General Photographic Services

Medical Photography

a. **Patient Photography** - Patient Photography is done to illustrate anatomic and pathologic subjects. Among the subjects that the medical photographer routinely photographs are anatomical disorders, plastic surgery cases, and dermatologic diseases (see fig. 3). Photographs are also important in medico-legal matters. The medical photographer is often called in to document cases of suspected physical abuse.

b. **Operating and Emergency Room Photography** - The medical photographer must be adept at working in the operating room to photograph novel surgical procedures. The photographer can also be called at a moments notice to work in the Emergency Room in order to document emergency treatment. Frequently, in these situations, the photographer must work in very restrictive conditions in order to obtain images that will make effective teaching material. The medical photographer must also be adept at working with special surgical lighting, and comprehend the principles of macro photography (see fig. 4).

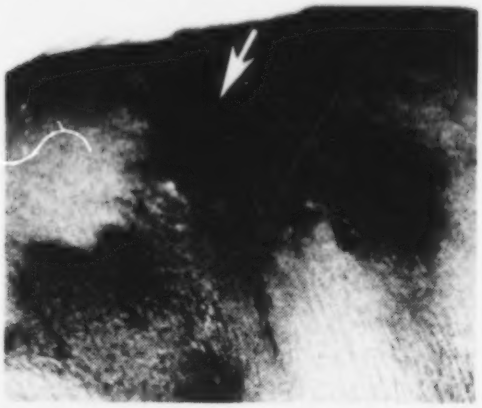


Figure 3 *Patient Photography* Skin lesion from a diabetic dialysis patient.

c. **Studio Photography of Medical Specimens** - Studio Photography is usually, but not limited to, photographing surgical specimens, medical devices, and research materials for publication or presentation. For example, we have been called upon to photograph pathological specimens obtained from research animals in order to document differences between treated and untreated animals (see fig. 5).

General Photographic Services

EMD also offers the faculty the same general photographic services available through commercial labs. These services include:

- Slides - flat copy, books, journals and art work (i.e. b/w, diazo, color, multi-color, slide duplicates).
- Prints - continuous tone and line (i.e. autoradiographs, archival prints, graphs, x-rays).
- Location Photography - Public Relations, portraiture, special events, brochures.

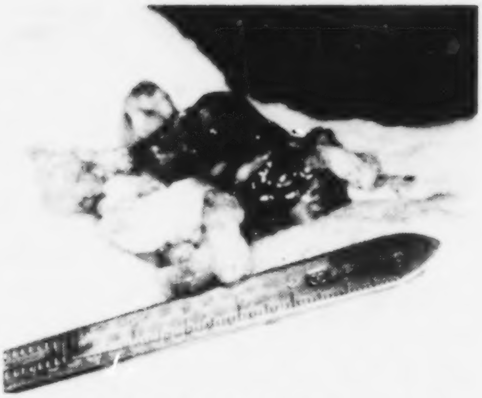


Figure 4 *Operating Room Photography* Very unusual presentation of atrial myxoma, a rare tumor of the heart. Note inclusion of scalpel handle for scale.

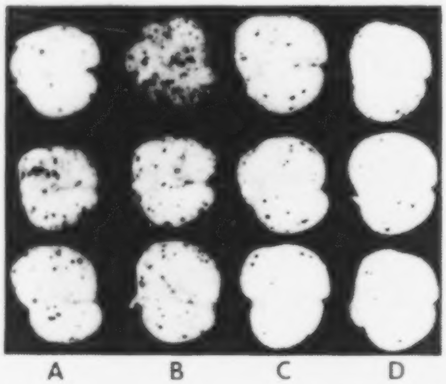
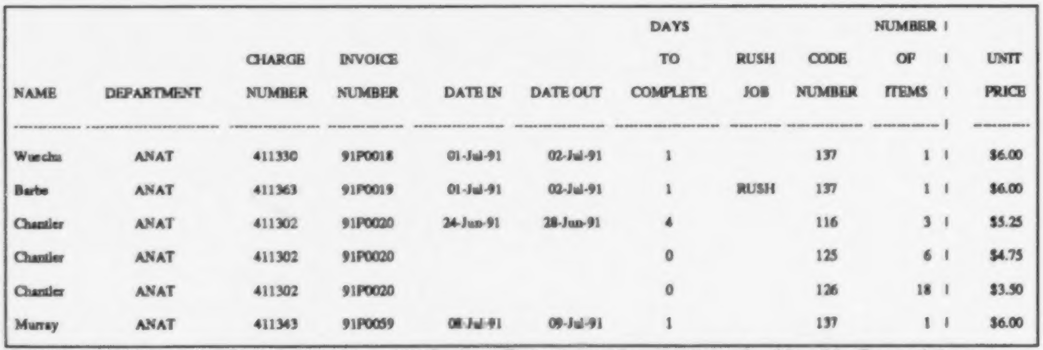


Figure 5 *Studio Photography of Research Results* The effect of a monoclonal antibody on melanoma induced tumor cell metastasis in mice. Tumor colonies appear as black dots.

Many projects involve both Photography and Electronic Media. One example is a slide/tape show titled "Producing Effective Slides". This self-contained educational module contrasts "good versus poor" lecture slides. Another example is Computer Aided Instruction (CAI) program development. While this is done through the Office of Medical of Education, producing CAI programs requires the collaboration of both the Photo and Electronic Media Sections.



NAME	DEPARTMENT	CHARGE NUMBER	INVOICE NUMBER	DATE IN	DATE OUT	DAYS TO COMPLETE	RUSH JOB	CODE NUMBER	NUMBER OF ITEMS	UNIT PRICE
Wuechu	ANAT	411330	91P0018	01-Jul-91	02-Jul-91	1		137	1	$6.00
Barbe	ANAT	411363	91P0019	01-Jul-91	02-Jul-91	1	RUSH	137	1	$6.00
Chantler	ANAT	411302	91P0020	24-Jun-91	28-Jun-91	4		116	3	$5.25
Chantler	ANAT	411302	91P0020			0		125	6	$4.75
Chantler	ANAT	411302	91P0020			0		126	18	$3.50
Murray	ANAT	411343	91P0059	08-Jul-91	09-Jul-91	1		137	1	$6.00

Figure 6 *EMD's Information Management System* Representative section of a Monthly Spreadsheet.

How do you Organize an Effective Educational Media Division ?

The key to organizing an effective EMD is the ability to capture and use relevant data. We realized that we needed to be able to accurately track our past and current production, so that we could predict our future needs. Using a personal computer and a popular spreadsheet program we created a system for logging in job orders. The computer spreadsheet is an information management tool that we use to collect, store, manipulate, and sort our production and financial data (see fig. 6). The data is used to construct a model of our operation from both a production and financial viewpoint. Once all of the pertinent information is entered into the spreadsheet, we extract the data for analysis in order to spot trends or make predictions based on our models. Using this system we can:

- Track historical trends in our production.
- Identify which services our clients currently use and recognize which types of media could be better utilized by the faculty to enhance their presentations.

It also serves to:

- Control costs
- Monitor turnaround time
- Manage production
- Estimate future equipment and staffing needs.

Briefly, the tracking system operates as follows. Each particular service that we provide is assigned a unique code number. When a client sends us work, the name of the person requesting the job, the department name, an assigned invoice number, and the service code are entered into the computer on the spreadsheet. At the end of the month this data is sorted by department, job type, and by revenue generated.

We find this data to be invaluable for:

- Reviewing departmental usage patterns
- Evaluating and regulating production management
- Assessing equipment and staffing needs

Reviewing Departmental Usage Patterns

We use the information from the Departmental Revenue spreadsheet to determine:

- Which departments are using our services.
- How much revenue we are generating from each particular department.
- What products or services are used the most.

Evaluating and Regulating Production Management

- If we see that a department is relying too heavily on one type of media (e.g. slides) we might show them how they could be more effective by using a variety of media (e.g., videotapes, overheads or poster presentations).

- We also analyze these numbers from a quality control and turnaround time standpoint.

- In addition, the data is applied to a cost/benefit analysis to evaluate the feasibility of introducing new products.

Assessing Equipment and Staffing Needs

- We assess staffing needs on a weekly, monthly and a yearly basis. We regularly analyze our production and revenue figures and review historical trends in order to gauge the need for freelancers in the coming months.

- At the end of the year we use our annual summary of production and revenue to justify new equipment purchases and/or hiring of additional staff.

In conclusion, the job tracking system enables us to predict the future needs of our clients and our Division, and consequently we are in a better position to provide for the educational needs of our medical staff.

SUMMARY AND CONCLUSION

To be effective, an educational media division must do more than just create slides and set up audio-visual equipment. Educational media professionals must be competent at turning the ideas of the faculty into visual media that effectively conveys those ideas. Thus, the Educational Media Division is a partner in the educational process. We strive to not only produce visual media, we work with faculty in order to provide more effective media.

As we have demonstrated, our staff is trained in techniques distinctive to the production of educational media at a Medical College, and since they produce educational media every day, we feel that they are able to provide superior quality control of the final product. Our staff endeavors to create a professional and consistent image for all media produced at the Medical College of Pennsylvania. This means that we help our clients to produce presentations that are consistent in image with our institution's standards.

In conclusion, the Educational Media Divisions's goal is to provide the faculty with the best possible media products and to teach how to use them effectively. It is important to mention that the Office of Medical Education offers a service unique among the Philadelphia area Medical schools in that it conducts seminars on effective teaching. One of the segments in these seminars is teaching the faculty to use visual media effectively.

Over the past decade we have seen an increased reliance in the use of visual media within our institution. During the last four years EMD has seen a two-fold increase in use by its clients (see fig. 7).

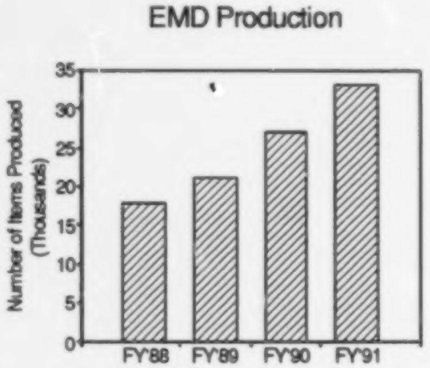


Figure 7 EMD production for Fiscal Years 1988-1991

This is due not only to MCP's expanding commitment to improving medical education, including visual training, but also to the positive service-oriented image projected by EMD. Thus we are confident that we will have a greater role in medical training, as medical educators become more aware of the importance of teaching visual literacy to future health care providers.

The authors wish to acknowledge the contribution of Ms. Bernadette Mathis and Mr. Larry Protivnak for producing the photographs that illustrate this paper. We would also like to thank Ziauddin Ahmed, M.D., Assistant Professor, Division of Nephrology, George Tuszynski, Ph.D., Professor, Department of Physiology and Biochemistry, and Glenn Whitman, M.D., Division Chief, Division of Cardiothoracic Surgery, for their permission to use the photographs.

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Working with Visually Impaired Students to Design Audiovisual Materials

Betty P. Cleaver
Mary E. Shorey

The connections between the elements of visual literacy and the design of visual materials are fairly clear, but when the element of blindness is factored in, the connections become more tenuous. Working with blind students should be more like working with any other students than different, and yet sighted persons, teachers and students, tend to emphasize the differences, not the similarities. Blind students (perhaps we should describe them as visually impaired, which denotes a range of visual ability) are categorized as exceptional students. Exceptionality is a category of multicultural education, an educational reform movement which promotes the inclusion of all children in the educational endeavor.

Exceptional students "are those whose differences are significant enough to require a specially designed program of instruction in order for them to achieve educational equity" (Heward and Orlansky, 1989, p. 233). Just as the range of visual impairment goes from partial sightedness to total blindness, so can the specially designed instruction range from adaptation of methods to a completely different instructional approach.

Before examining how to teach visual skills to visually impaired students, we should consider what educators of the blind have to say about teaching the blind. Scholl refers to the work of Kirtley, Tuttle, and others, stating that, in general, attitudes toward people with visual impairments tend to be negative "and to focus on what the person cannot do rather than what he can do. Coping with negative attitudes is frequently a greater challenge to a blind person than coping with the impairment" (Scholl, 1986, p. 24).

Blindness imposes limitations on how the individual interacts with the environment, it is true, but sighted persons may impose further limitations by their unwillingness to acknowledge that "visually handicapped persons can achieve 'successful levels of personal, social, and economic adjustment when given the necessary opportunities for doing so'" (Kirtley, quoted by Scholl, 1986, p. 25).

Blindness, said Berthold Lowenfeld (quoted by Scholl, 1986, p. 25), "imposes three basic limitations on the individual:

1. In the range and variety of experiences.
2. In the ability to get about.
3. In the control of the environment and the self in relation to it."

Teachers of visually impaired students can lessen the impact of the first limitation, the range and variety of experiences, by modifying the activities and demands of the regular curriculum to provide equally instructive, demanding, and expansive experiences that are within the capabilities of the visually impaired learner. The instructional program is not "watered down," but it is modified to improve its effectiveness. By careful observation of the visually impaired student's abilities and skills, the instructor can focus on what the student can do and plan experiences which will build on and expand those capabilities.

Visual Literacy for the Visually Impaired

Visual literacy is not an absolute but a continuum. Visually impaired students may fit into several points on this continuum, depending on their range of blindness, or sightedness. The visual elements Dondis identifies (1973, p. 39)– dot, line, shape, direction, tone, color, texture, dimension, scale, and movement– can be understood in varying degrees by visually impaired students. Obviously, tone and color will be more difficult than other elements such as shape and texture. However, visual impairment is also a continuum, and color is an important element to communicate.

The experience of the authors with two adult teacher education students who were also blind may be instructive. They were required to take the course, Basic Media Skills, as part of their teaching certification requirement. When modifications to the course were made and special help provided, these students learned design concepts, gained production skills, and produced learning centers which, they believe, will enable them to be more effective teachers of blind or partially sighted students.

The course requires students to attend to four basic design considerations– attracting attention, readability, organization, and visual appeal– in designing a display (Shorey, 1983, p. 46). By putting these considerations in the context of the tactile rather than the visual sense, the design considerations are transferable. For example, readability may mean that a shape on a display board should have edges crisp to the touch and should be raised enough from the board for the user to distinguish it. Simplicity would mean that the number and type of shapes should be limited to minimize confusion. There should be some unity in the display, in the repetition of shapes or textures, space around the principal shapes, and some tactile connection of the display elements.

There are some tactile teaching materials available on the market but, in many cases they have not been successful because the need for tactile differentiation has not been met. Research studies done on the use of tactile graphics for social studies have indicated that tactile maps, due to design flaws, often have poor legibility; while other research has found that a verbal description and use of a graphic are more effective for visually impaired students than either method used alone (Morris, 1986, p. 364).

Morris refers to a study by Berla which "identifies design considerations that contribute to tactile clarity... size, figure-ground features, orientation of shapes, use of symmetrical vs. asymmetrical figures, and redundancy of tactile stimuli" (Morris, 1986, pp. 364-365).

Teacher Education Requirements

In many states teacher education programs are expected to prepare the pre-service teacher with basic media knowledge and skills– how to select visual and auditory instructional materials, how to produce them, and how to use them in the classroom. The tenets of visual literacy provide the foundation for such a program.

In examining the literature on methods of teaching we found that students who are visually impaired are expected to gain the same visual and verbal skills as their sighted peers. Alonso's *Student Teaching Guide for Blind and Visually Impaired University Students: Adapted Methods and Procedures* addresses visually impaired students, discussing the personal skills needed for success in student teaching.

"As a visually impaired or blind candidate for student teaching," she says, " you will need specific personal skills to enable you to be successful. The ability to use common or adapted media and materials together with reader services will facilitate satisfactory classroom management and instruction" (Alonso, 1987, p. 1).

The list of basic required skills she identifies includes media skills. The media skills are (Alonso, 1987, p. 1):

- Skills in operating audiovisual equipment such as film, slide, and filmstrip projectors
- Skill in using the chalkboard
- Knowledge of techniques of preparing and using sequential transparencies with the overhead projector
- Skill in planning and putting together a bulletin board
- Interpretive skills for using graphs, maps, tables, diagrams and pictures
- Skill in using a flip-chart

This paper describes how a basic media skills course which is required for teacher education and certification at The Ohio State University was adapted to the needs of two blind teacher education students. Also discussed are the rationale for the adaptations to the course and the methods the instructor used in working with these students.

Teachers generally are not prepared to work with visually impaired students; in the general teacher education program the emphasis seems to be on "awareness," not "how to." How can teachers work with visually impaired students to ensure that they derive maximum benefit from their school experience? What modifications to classroom projects or assignments should be made? What can be expected in the way of performance? How or when should the teacher assist the student? The understandings the instructor gained over the ten week course may provide insight into these teaching problems.

The Basic Media Skills Course

These two students are in a teacher education program and plan to teach visually impaired elementary children. They are adult women in their twenties who at one time were sighted. The fact that they each had sight when they were younger enabled them to do some visual thinking as they planned their projects. They enrolled in the course because it is required of all education majors. All institutions of higher education in Ohio which prepare teachers are required to prepare them in the selection, preparation, and utilization of educational media (State Board of Education, 1975).

When the women were asked if they had considered getting excused from the course because of their disabilities, they were quick to respond, "Never!" They went on to say that they will be teaching students who themselves have varying degrees of impairment, from partial sight to total blindness. "We want to learn how to design and produce visual instructional materials which can be used by anyone."

In the past, only one blind and three visually impaired students had taken the basic media skills course. Only minor adjustments in the course design were made for those students. When, by coincidence, the two blind students enrolled in the course during the same quarter, the instructor saw an opportunity to explore some course modifications and individualized activities, which might prove more beneficial for these students than the usual tasks of projector operation and utilization.

The two women met with the instructor and discussed the objectives of the course and how the course could best serve them and the population they would be teaching. It was decided that they would design and each produce a learning center. They would work together to design the center but each would do her own production tasks.

The instructor pointed out that designing and producing a learning center would synthesize many skills taught in the course; it would call on design skills and could incorporate visual, auditory, and tactile materials. The women chose "Transportation" as a theme–transportation on land, sea, or through the air. They felt that this center would be multipurpose. It could be used in social studies classes as well as in safety lessons.

The Materials

Once the theme was set, a plan was developed. The instructor and students set aside one afternoon a week for the project. This was comparable to the typical media skills course pattern of one hour of formal class instruction and one to two hours of lab per week. For this project, a block of time was scheduled when the instructor could work exclusively with the two women.

Materials for the learning center were important. They had to be tactile and durable. The women will be working with both totally blind and visually impaired students, so the color and contrast of the materials also had to be taken into consideration. Shaw (1986) cites Jones as suggesting that maximum use of color, shape, and texture is important in display for both the totally blind student and the student with limited vision. "This [use] enables the youngster to maximize the sensory input of each quality and yields a more interesting multisensory product" (p. 392).

The instructor provided corrugated boards which were grooved to form a threefold stand-alone center. Felt was suggested for the large lettering on the board and commercially made vinyl letters for the captions. The vinyl letters provided raised surfaces which would stand out from the board enough that the student using the board could distinguish the letters.

Much of the students' early discussion revolved around what materials could be used for the raised surfaces (representing objects) that they would attach to the boards; in planning the tactile dimensions, they wanted the "feel" of the materials used for a particular surface to suggest something about the mode of transportation it represented. For example, they chose aluminum foil for a rocket because "a rocket is smooth and speeds through the air." Under the rocket they placed a shape cut from sandpaper because "the fire from the rocket is harsh and uncomfortable." Then they placed vinyl letters spelling out "Rocket" and over these letters they placed a strip of Braille which also spelled "Rocket."

They went through the same planning and reasoning process for all the modes of transportation to be represented on the board. The considerations the students took into account as they planned their learning centers met the requirements of the course and are very similar to the considerations Berla identified.

The instructor saw her task as one in which she would suggest, guide, and aid the students. Outside of class, the project became a group effort. A parent helped one of the students secure a coloring book of patterns for the transportation vehicles. A sister went shopping with the other student for toy vehicles which would be used in the learning center.

The women visited the music section of the fine arts library on campus to find appropriate sound effects and music they wished to use for the audiotape which would accompany the board. "Readers" (student volunteers) found necessary information and poetry on various forms of transportation for the verbal part of the audiotape. One of the women edited the sounds and voice for the tape on her home stereo system.

The major work on the display, however, was done in the media lab. While in the lab the women decided on the vehicles in the coloring book which they wanted to have represented on the board. The patterns were cut from manila folders by the "readers," outside of class. The actual production work which the women did individually consisted of

- covering the display boards,
- tracing the letters (later cut by the "readers"),
- selecting and cutting the cloth which would cover the patterns (with some help from the instructor),
- gluing the cloth to the patterns, and
- preparing the felt letters (sequencing & gluing) for the instructor to position and adhere to the boards.

The women used the permanent rubber cement technique to attach the patterns, brushing the surface of the board and the back of the patterns with cement, and then securing the patterns to the boards. This was done with minimal help from the instructor who, however, needed to be alert to the movement and mood of the students at all times. The instructor's responsibility was not only to direct, but to be perceptive enough to identify points in the project when frustration or confusion might occur in the activity and where physical help might be needed in completing the task.

Because these women were so independent and enthusiastic, frustration seldom occurred. But by keeping things moving at a relatively quick pace and keeping the conversation and direction light, the project was successfully completed. If there was a point when the task seemed to be bogging down for the student, the instructor would take over for a moment to "touch up" the work and then set things in motion again. Words of encouragement and approval were given freely and often. The women could do these tasks and did them well.

Special Techniques

In discussing the work of Lisenco on curricular adaptations for the visually impaired, Shaw says, "The blind person must learn to use touch flexibly and to combine the information yielded by touch with other sensory input." Lisenco contends that there are various ways blind persons explore the environment with their hands, "...by smoothing, rubbing, tapping, grasping,.... each action differs in the variety and preciseness of information it transmits" (Shaw, 1986, p. 392).

The instructor sometimes guided the students' hands, the "hand-over-hand technique," to help the women explore the dimensions of the board and possible positions for the objects, and where materials were located on the work table. All "showing" was done with hands.

Shaw (1986) refers to Haupt's points on helping students achieve success in art experiences. Several of these points were considered when experimenting with instructional techniques. It is suggested that "time and intense handling [are necessary] to explore objects in depth if clear concepts are to be formed" (p. 387). In this case, the time was shortened dramatically because these women both had had sight at one time and could visualize most of what they were working with. Still, extra time was needed for the physical tasks and the examination of the objects which they produced.

Another suggestion is that "vocabulary that is rich in descriptive terminology and that describes qualities in the 'experience realm of [the blind person's] remaining senses'" be used (Shaw, 1986, p. 392). The project lent itself well to this. We were dealing with touch (of tactile materials) and sound (from the audiotape). The tactile materials were "smooth," "rough," and "bumpy." But they were also "shiny" and "bright." The women are not only blind, themselves, but are pursuing degrees for teaching the blind or visually impaired. They felt that a "shiny" rocket would catch the attention of a student with some sight– and bright and contrasting objects would help the partially sighted student better recognize the objects. With this in mind, the instructor used descriptive words of color as well as touch and sound throughout the entire project.

It was interesting to note that the women would remember and refer back to the colors of the letters and objects much more frequently than to any other attribute of their boards. Incredible memory training was taking place in the personalization and production of their boards. The color of the letters and objects and the position of the objects on the boards were learned almost instantaneously by the women from the onset of the production. This is undoubtedly a survival skill that these women incorporate into their everyday lives.

The Product

The tactile board, the audiocassette, and the toys in the learning center work together to give the learner multisensory information. Listening is of course important for the visually impaired student. Heinze (1986) suggests that "listening involves several steps– an awareness of and attention to relevant sound discrimination, identification of that sound, and finally, assignment of meaning to the sound– in order for the listener to receive his 'message'" (p. 306).

The women have included various forms of information in the audiotape they produced:

- sound effects of the individual vehicles,
- descriptive information about each vehicle, and
- songs and poetry about the various vehicles.

The student listens to the sound, tries to guess what vehicle the sound represents, then listens to the descriptive information about the vehicle. The student then goes to the board and locates the object, reads the Braille and print name of the object, and moves to the toy box in which is found a miniature representation of the vehicle just learned about.

In her discussion of Haupt's points, Shaw (1986) suggests that first hand experiences with all objects used in daily life are important so the blind student will have "the basis for describing newly experienced objects" (p. 392). It would be difficult for the student to have first hand experience with each of the actual sized vehicles represented in the learning center. Therefore the miniature vehicles are available for handling and exploring. These toys (a school bus, an "over-the-road" bus, a sailboat, a motorboat, a space shuttle, an airplane, a police car, and a tractor) are quite realistic in scale and detail.

Outcomes

What did these women learn from this experience? They learned something about instructional design– clarifying instructional objectives and designing instruction appropriate for the intended learner. They learned some visual design skills, which they transposed into tactile design skills. They worked hard on production tasks and felt proud of the production skills they gained. They gathered their own materials from a variety of sources and they did their own research; out of this came a greater knowledge of resources available to them.

They plan to use these skills in their teaching and they hope to teach some production skills to their visually impaired students. One learning outcome was unexpected. As they worked together they helped each other, and they discovered that each had expertise in different areas. "Helping each other helped me learn some techniques for helping other blind people," one said. "Best of all," said the other, "I did things I never dreamed I could do! I have a much better awareness of my own abilities."

Implications for Teachers

Teachers who are in visual education programs combine their knowledge of special techniques for working with visually impaired students with a knowledge of good pedagogical practice. On the other hand, general education teachers who happen to have a visually impaired student in class begin with a background of good pedagogical knowledge and must add special techniques to their repertoire of teaching skills. This calls for a significant commitment of time and energy. Where can one start to learn how to assist such a student within the confines of the classroom?

Certainly there are other teachers who have worked with visually impaired students and would share their expertise, and a great deal can be learned by observing visually impaired students as they attack a learning task. Talking with the students and asking what kind of help they need to fit easily into the classroom environment is an approach so obvious that it is often ignored.

It helps for teachers to have an awareness of the impact of blindness or visual impairment on a student's emotional, social, and intellectual growth. This awareness is gained through reading, observation, and direct personal contact. Being aware of their special needs leads to sensitivity to the special challenges these students face and is the teacher's motivation to look for ways to modify the environment to promote learning. The general education teacher can help visually impaired students by adapting materials, by fitting teaching strategies to the abilities of the student, and by providing emotional support and encouragement in the learning process.

A Final Note

Adapting the Basic Media Skills course was well worth the effort. The satisfaction with their accomplishments that the two women felt came through in words and shone through their smiles. That's reason enough to adapt methods, improvise, and encourage students with disabilities.

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Note: The authors videotaped the women at various stages in the production of their learning centers, as well as during their presentation to a class.

For information about the the videotape, call the authors at (614) 292-1177.

Perceptual Factors in the Study of Television Aesthetics

Nikos Metallinos

Abstract

Knowledge of the processes involved in visual and auditory perception, as well as basic understanding of the mechanisms employed by the human brain in transforming perceptions into cognitions are prerequisites for the study of television aesthetics. Numerous scientific studies now found in such diversified fields as perceptual psychology, neurophysiology, experimental psychology, cybernetics, and communication confirm how fundamentally important perception is to the study of the structure of television images. This, in turn, is of great significance for the study of the field of television aesthetics. This paper (a) reviews the most appropriate sources in the literature of visual and auditory perception as they relate to television aesthetics, (b) examines the predominant visual, auditory, and kinetic (motion) factors involved in structuring television images, and (c) discusses the role of perception in the development of television pictures with an aesthetic merit.

INTRODUCTION AND REVIEW OF LITERATURE

The field of television aesthetics like the similar fields of aesthetics in painting, photography, and, generally, the arts, evolved from the field of criticism. The description, interpretation, and evaluation of television programs by various television commentators, observers, and critics generated the need to examine the critical statements more thoroughly and to relate them to the medium of television. It is for this reason that criticism of the arts has also been named meta-criticism, and television meta-criticism is synonymous with the term television aesthetics (Dickie, 1971).

The efforts of pioneer television critics during the last fifty years, first to identify and then to describe, interpret, and evaluate the various features of television programs, might have resulted in the development of the field of television criticism. However, since the majority of these critics derived from such conventional disciplines as sociology, anthropology, journalism, semiotics, linguistics, English, etc., the discipline of television criticism as a responsible academic discourse could not be fully developed and flourish. It was inevitable that with such limited and one-sided basic television criticism, television meta-criticism or television aesthetics not progress and fully develop.

Visual communicators and media scholars who have observed and pointed out this phenomenon have suggested that the domain of the field of television criticism, and subsequently, the field of television aesthetics must be expanded beyond the sociological, semiotic, or linguistic approaches which has been the practice during the last fifty years. The medium is not an isolated sociological or unique linguistic phenomenon to be studied only by these respected fields. It is a complex phenomenon which is better understood if it is examined from all sides and by many different disciplines whether they fall under the arts or under the sciences. The visual communication media scholars of today have observed, studied, and concluded that the development of television criticism, which is the basis for the establishment of the discipline of television aesthetics, must expand and must take into consideration the findings in the fields of perceptual psychology, neurophysiology, experimental psychology, cybernetics, education, fine arts, communication studies, etc.

The studies on television criticism and television aesthetics of a great number of pioneer scholars, as well as our own studies, have indicated that the three-axes, the three bases upon which the discipline of television aesthetics should be built are perception, cognition, and composition (Metallinos, 1991). In this paper we focus only on the perceptual factors in the study of television aesthetics and we examine the roles played by vision, hearing, and motion in the perception of television images.

Specifically, in this section of this paper a brief review of the literary sources pertaining to the above perceptual factors in the study of television aesthetics is provided. The second part examines the predominant visual factors involved in the perception of television images. The third section analyses the key auditory factors, whereas the fourth part of this paper discusses the major kinetic or motion factors in the perception of television images.

Television aesthetics is the study of sensory data and images. Consequently, the major fields which contain the bulk of literary sources on the discipline are perceptual psychology, neurophysiology, art criticism, and communication. Since the discipline is still in the making and it has not, as yet, fully developed its parameters, the scholars of television aesthetics are constantly borrowing from numerous other academic disciplines to support their research findings. As difficult as this task may be, it has shown that it is both necessary and fruitful.

Among the present day communication scholars who have borrowed and have adopted—in their own research—from the perceptual psychologists and the neurophysiologists are J. Fletcher, R. Tiemens, M. Malik, and H. Zettl.

James E. Fletcher (1985), a communication scholar of the University of Georgia, has used the psychophysiological instruments, mostly the Galvanic Skin Response (GSR) as measuring devices in his television production related research (Fletcher, 1971, 1976, 1977, 1978, 1979, 1985).

In addition to this background in communication research, Fletcher has borrowed heavily from Berlyne (1960), Edelberg (1970), Lykken and Venables (1971), Martin (1967), and Shapiro (1969), all renowned researchers in neurophysiology and experimental psychology. Fletcher's empirical studies found in the journals and the literature of both fields have contributed decisively in the development of television aesthetics as a distinctive academic study and discipline.

Robert K. Tiemens (1975), a communication scholar at the University of New Mexico, has studied and published extensively such television production related issues as: Some relationships of camera angle to communication credibility (Tiemens, 1970), The syntax of visual messages: An empirical investigation of the asymmetry of the frame theory (Avery & Tiemens, 1975), Image size as an element of visual language (Tiemens & Acker, 1976), A visual analysis of the 1976 presidential debates (Tiemens, 1978), Children's perception of size in televised images (Tiemens and Acker, 1981), etc.

In his research, Tiemens (1975), borrowed heavily from such known perceptual psychologists as Arnheim (1974), Gazzanika (1967), Gibson (1974), Ornstein (1972), etc. Tiemens' research works, articles, and papers which can be found in all the major communication journals, have significantly helped the development of television aesthetics as a unique academic discourse.

Miroslav F. Malik (1987) a communication scholar from Czechoslovakia is among the first media researchers who established a Biocybernetic Research Laboratory at Concordia University in Montreal to study moving images, mostly film and television pictures. In his research, Malik used such advanced visual image measuring devices as Eye-trucking cameras, Pupilometers, Galvanic Skin Responses (GSR), Electroencephalograms (EEG), and Electrocardiograms (EKG).

Malik's major work is contained in his monograph Biocybernetic Communication Research (1987). Among his other major publications and papers are: Information design (Malik, 1976), Videophysiology (1978), Biometric approach to communication process (Malik & Thwaites, 1984). Malik has studied neurophysiology at the University of Prague and has extensively quoted in his media-related research such notable neurophysiologists and perceptual psychologists as: Axelrod (1976), Briggs and Swanson (1970), Hubert and Wiesel (1970), Snyder (1982), Young and Sheena (1975), etc. Malik's contribution in the area of research methodologies for the visual communication media, in general, and the television medium, in particular, are substantial. His Biocybernetic Laboratory has encouraged several communication scholars, teachers and students, to pursue scientific studies in visual communication media.

Herbert Zettl (1973), a broadcast communication arts scholar at San Francisco State University, is considered the founder of television aesthetics as a distinct field of study. Zettl is among the most diversified media scholars having mastered the fields of music, painting, television production, media education, and visual arts, to mention only a few. Zettl's main works, the two books Television Production Handbook (1990), and Sight, Sound, Motion: Applied Media Aesthetics (1990) have been, for the last twenty-five years, the major text books in television production and television aesthetics respectively, and they have been translated into various languages around the world. Among Zettl's other noticeable publications and paper presentations on television aesthetics are: The paradox of education television and the educational process (1967), The study of media aesthetics (1978), Languages of television: The language of television criticism (1978), Video in depth: Multiple monitors show subtext (1985), The graphication and personification of television news (1989), etc. Among the numerous perceptual psychologists, neurophysiologists, Gestalt psychologists, and art psychologists quoted most frequently by Zettl are Arnheim (1953, 1969, 1969), Dondis (1973), Goldberg (1951), Goldstein (1975), Kepes (1944), Koffka (1935), Tarroni (1979), etc. Zettl's basic approach to the study of television is the inductive analysis of the basic picture elements of lights, colors, two and three-dimensional space, time, motion, editing, and sound. He is a contextualist who believes that since life and art are inseparable, so should the television picture and the entire television program be live and artistic, elevating viewers' involvement and appreciation.

From the research works of these scholars and their numerous disciples we have extracted and gathered together the major perceptual factors—visual, auditory, and motion—which, in our view, constitute the parameters of the first axis of the study of television aesthetics. Herein a synoptic description of the visual, auditory, and motion factors is provided.

Visual Perception: Defining the Visual Field of the Television Screen

Any attempt to define the visual field of the television screen will be fruitless unless we clearly understand and thoroughly examine both the organs and the processes involved in visual perception. In this section, such basic visual communication related processes as (a) visual stimuli, (b) the peripheral vision, (d) the perception of elements within the visual field, and (e) the perceptions of holographic and three dimensional visual displays are briefly examined in relation to television images.

Visual Stimuli

Visual perception is a highly important sensing system. More information reaches the human brain through the eyes than through any other sense organ. Most organisms have two eyes, either both in front or one on each side. For most mammals the gradual change from sideways to frontal looking eyes came about as precise judgment of distance became important. The use of two eyes cooperating to give stereovision is an important process in visual perception. Sight developed as living organisms needed to react to the electromagnetic energy we call light. Light is essential to life. It is necessary for most organisms to live and to grow in. It is the key ingredient to visual perception and to orient us in space and time. The receptors of the eyes are sensitive to only that tiny portion of the vast spectrum of electromagnetic radiation which we call light. The visible spectrum measures 400 to 700 nanometers wavelength.

Light strikes the eye; it travels through the complex structure of the eyeball to the retina where it is translated into electrical energy and then it is transmitted to the brain where it is organized, decoded, and perceived.

In order to understand this entire process we need to know first the physiology of the eye. This entails a clear understanding of the various parts of the eyes and their functions. Since the television camera was developed from the anatomy of the human eye to which it has a great resemblance, knowledge of the physiology of the eyes and the nature, the role, and the specific functions of the lens, iris, pupil, cornea, retina, fobea, the rods and cones, the optic nerve, etc. are necessary. Second, we need to fully comprehend the mechanism of visual perception step by step; that is we need to understand what is going on in the eye from the moment the light strikes the camera, transfers into the light sensitive receptors at the back of the eyeball (the rods and the cones) and then, through the optic nerve to the brain. Third, we must learn to distinguish the potential stimuli exposed in the visual world from those of the effective stimuli (picked up by the eye) and the unaffected stimuli (ignored or overlooked by the eye).

The Perceptual Process of Television Images

The potential stimuli of the visual world, objects, events, sounds, etc. around us can all be thought of as distal stimuli. They are at a distance and they elicit electromagnetic waves. As long as such waves reach the receptors of our senses and they interact, they become proximal stimuli. They arrive in the organs of perception and are ready to be processed. Our sense receptors process the proximal stimuli as chemical reactions and transmit them to the brain. When the brain receives a stimulus as a chain reaction it perceives it. The responses of the brain are the perceived stimuli now known as cognitions.

Visual perception, as with any other sense, depends upon incoming stimuli to activate the receptor cells, otherwise we would not sense. Let us see what happens when we look at a television program.

The television set itself, and the light coming from the picture on the television screen are the distal stimuli. They are there, in the environment. The light that emanates from the screen enters the cornea and the lens of our eyes, travels through the fluid chamber of the eyeball, and strikes the retina. The light impinges on the receptor cells, the rods, and cones and can now be called proximal stimuli. This stimuli will then be processed within the light receptors and then to the brain for interpretation and understanding. In the brain, the proximal stimuli become the perceived stimuli.

Central and Peripheral Vision and Television Images

The discussion of the central and peripheral vision as they relate to television images entails an examination of what the domains of the central and the peripheral vision are. What the differences between the visual world and the visual field are. And what the differences between the big (film) and small (television) screens are.

Our eyes do not operate independently of each other. Neither eye can be moved without the other being effected in some way. There is an area in our field of vision where both eyes see the same objects and events but at a slightly different angle. The overlap measures approximately 120 degrees given as binocular vision. Binocular vision allows us to see—perceive—depth. Without it, we would live in the flat world of height and width.

The center of the overlapping field is known as central vision. This type of vision is very precise and accurate. At the perimeter of our visual field is our peripheral vision. Although it usually remains out of focus, peripheral vision is particularly sensitive to movement and contours.

Our total span of vision is 180 degrees horizontally and 150 degrees vertically. This restriction in our visual field has resulted in the rectangular shape, usually 3:4 aspect ration of the television screen.

As we take a look around us we see objects and experience events as they relate to us. This is our visual world. The streets, the people, everything around us is real and tangible. But when we see and experience the same objects and events reproduced on the screen they appear changed, usually smaller, and often less. The phenomena in the real world are different than the same phenomena when they appear in the visual field.

The television camera captures only a small fragment of the visual world. The camera's visual field is transmitted to thousands of television screens around the world. Often we see only a bird's eye view of the world and world events. The images on television are reproductions of the real world which have been edited, manipulated, and squeezed onto the television visual field.

The perception of the television screen is quite unlike that of the film screen. The relative small size of the traditional television screen means that we usually exercise only our central vision while watching television. The eyes have very little space over which to move. Consequently most of the information value of objects on the screen is obtained immediately.

In the movie houses because the screen is so much larger we experience both central and peripheral visions. Since we do not see all of the screen at once, our eyes and head move constantly. In this way our brain is kept more active in its effort to piece all fragments of the screen together. We remain more alert. The size difference of the two screens—film and television—causes the image size of objects and events to look bigger or smaller, more powerful or weaker. The film images are visually louder than the images of the small television set. A large image exerts more aesthetic energy than a smaller image, or the same image on a smaller screen. At the theatre we perceive people and things as being of dramatic proportion, not only physically, but also psychologically. The landscape carries as much energy as the people; both are overwhelmingly strong and in competition for screen space. On the large movie screen the simple act of a man walking down a country rode becomes a gesture. On the small screen this remains a simple act (Zettl, 1990).

The Perception of Elements Within the Visual Field

The analysis of the central and peripheral vision—which brought into focus the properties of the small (television) and the large (film) screens—leads to the examination of the perception of the visual elements of light, color, image size, image

pattern, shape, and direction which appear on the small television screen. The analysis of motion of the visual elements is discussed separately in the fourth part of this paper.

The television picture is an interplay of lights and colors. It is, therefore, important to understand the properties of light and color if we are to comprehend how this visual medium operates.

Light is electromagnetic energy. It makes up a small part of the electromagnetic spectrum which includes radio waves, infrared, ultra-violet, X-rays, and gamma rays. What we see as light is the visible part of spectrum. It consists of wavelengths measuring between 400-570 nanometers. Color is a property of light. When light is bent by a prism each wavelength is deviated through a slightly different angle so that the emerging beam comes out of the prism as a fan of light, giving all the spectral colors.

When we look at objects or liquids we see light as it is reflected off them and when we see color we actually perceive three basic color sensations—the color itself which is called hue, the color's strength which is called saturation, and how light or dark a color appears which is called brightness. These three sensations are called color attributes. Unlike the old black and white television picture, today's color television pictures have all these attributes.

Color vision scientists (e.g., Guyton, 1986) have found that there are three different types of cones in the retina of the eyes each of which responds maximally to three different colors: blue, green, and red. The colors we see depend on which of the three cone types are activated and to what degree they are stimulated. Each type cone is excited most effectively by light of one particular wavelength but it also responds to other wavelengths. According to Vauder

(1985), "Our sensation of color depends upon the ratios of these three cone outputs and their comparison by higher order cells in the visual system" (pp. 655-656).

Light and color perceptions are also very important because they influence directly the perception of image size, pattern, shape, duration, etc. The difference of light and color of their borders determines the degree of our perception of them. The position, size, direction, and motion of objects and subjects in space are all directly related and can be perceived due to light and color.

The Perception of Holographic and Three-Dimensional Elements

This section briefly examines (a) the perception of holographic images, (b) the perception of three-dimensional images, and (c) the perception of the figure-ground hierarchy in television images.

In the real world we are used to seeing and relating to our surroundings in three dimensions. Until recently our artistic expressions in the mass media had been confined to two-dimensional means. Photography, film, and television are all flat media. They have no actual depth. The sense of the third dimension is an illusion created by manipulating subjective space. Recent developments in the fields of holography, film, and three-dimensional television imaging have made three-dimensional images to look almost realistic, almost three-dimensional. Objects in holograms and in three-dimensional film and television images appear to extend beyond the screen towards the viewer.

As the words holo (complete) and gram (message) connote, the hologram captures the entire message of the scene in all its visual properties, including the realism of the third dimension.

The magic of a hologram can be demystified if we understand light and how images are captured on film. In regular photography, light waves bounce off a subject and pass through a lens. The lens focuses the light waves onto an image and we see a flat two dimensional photo of the actual object. In holography, however, the lenses precisely guide the light which must be coherent or monochromatic and is known as laser (acronym from light amplification by the simulated emission of radiation) reflecting off all points of the subject. These light rays are recorded in three dimensions. Praising the perceptual property of holograms Kock (1969) states,

> The hologram plate itself resembles a window with the image scene appearing behind it in full depth. The viewer has available to him many views of the scene to see around the object in t he foreground, he simply raises his head or moves it left or right. (p. XI)

The many uses of holography today, which include air traffic control, radiative surgery and therapy, topography, computer aided design, supermarket counter checking, advertising, and education, is an additional reason for the student and the researcher of the visual communication media to examine the perceptual properties of holography vis-a-vis their potential covert effects (Metallinos, 1990).

An equally important perception factor is the three-dimensional television which is emerging rapidly thanks to the vigorous research of the Media Lab scholars at M.I.T. and the Japanese Industrial (Sony) and Education (NHK) technologists.

The three-dimensional television has not, as yet, been perfected. It is in the experimental stages where either the television cameras, the television sets, or the television viewers must use special converters, apparati which are substitutes to man's perceptual property of binocular vision. The volumetric three-dimensional imaging method (Balasubramonian & Rajapan, 1983) and the three-dimensional holographic television (Brand, 1987) are among the recent three-dimensional television in existence. Their massive application, however, might have negative results. Studies on this issue have shown that there are numerous perceptual and aesthetic drawbacks of the three-dimensional media which should be considered (Metallinos, 1990).

It is very important for television and for that matter for any visual art form, to maintain a figure-ground relationship otherwise viewers will not be able to distinguish objects from their background and they will not perceive depth properly. As Murch (1973) states, "The exchange [of figure-ground relationship] is marked by a modification of the apparent depth of the figure; the figure portion always appears to be infront of the ground" (p. 147).

We are compelled to structure what we see in the figure-ground relationship. Objects are constantly seen relative to a background. Because of this urge, we can achieve especially startling effects by rendering the figure-ground purposely ambiguous or by reversing them. Something like this is common practice in gimmicky advertising. In television, this effect can be produced by superimposition, quite effectively, particularly in dream sequences, etc.

Television would be a blur of moving images with little comprehension and minimum retention if the figure-ground relationship was in constant flip-flop. Maintaining a consistency in this hierarchy is imperative if we expect the viewers to properly perceive and make sense of television images (Metallinos, 1989).

Auditory Perception: Defining the Audio Dimensions of Television Images

An equally important, to the sight or vision, component of the television medium is sound which is often overlooked, taken for granted as being there. Empirical research on television sound which examines the role of audio in television aesthetics is practically non-existent (Metallinos, 1985).

We live in a society where most means of communication are through the process of sounds. The things we do or see often use sounds to be perceived and comprehended. For example, a television picture will be meaningless with the absence of sound. Sound emphasizes mood and provides meaning in a predominant visual medium such as television.

The effectiveness of sound depends upon the messages which are transmitted through the sound waves which can be manipulated with the audio technologies that exist within the medium of television.

In this section such basic audio communication related factors as (a) auditory stimuli process and mechanism of auditory perception, (b) perception of acoustic space, and (c) sound vs. noise in television are introduced and briefly discussed.

Auditory Stimuli: Process and Mechanism of Auditory Perception.

The ear captures sound waves from the surroundings. It turns them into bits of information and processes them to the brain for understanding. Before this entire mechanism of auditory perception is explained we need to know the fundamentals about the physiology of the ear and the various functions of the auditory stimuli.

The ear is made up of many different and complex organs. It is divided into three sections: the external ear, the middle ear, and the inner ear. The external ear helps us to capture and identify the directions of the sound source. The external ear consists of the ear flap or pinna and the ear canal or external auditory meatus which leads to the eardrum, or tympanic membrane. The ear canal varies both in shape and in size. The outer portion of the canal, about one-third of its length, is cartilaginous; the remaining two-thirds is bony. The canal takes on a somewhat s-shaped form and has a diameter of about 0.7 centimeters at its entrance. It gets smaller closer to the eardrum.

The middle ear begins with the inside part of the eardrum. In the middle ear cavity there are the three auditory ossicles. These three ossicles—the malleus, the inclus, and the stapes—transform sound vibrations into the inner ear. Also found in the middle ear is the eustachian tube. This tube is responsible for maintaining proper pressure equilibrium in the ear. The eustachian tube connects the middle ear to the pharynx. The slit-like ending of the tube in the pharynx is normally closed but during yawning, swallowing, or sneezing when the muscle movements of the pharynx open the entire passage, the pressure in the middle ear equilibrates with atmospheric pressure. A difference in pressure can also be produced with sudden changes in altitude such as in an elevator or airplane.

The inner ear is the area where sound vibrations are converted into electrical impulses and propagate through the auditory nerve to the brain for interpretation and understanding. The inner ear structures are contained within a system of spaces and canals, namely the osseous labyrinth. These spaces and canals are grossly divided into three sections: the vestibule, the cochlea, and the semi-circular canals.

The total range of hearing in a healthy young adult is between 16 and 20.000 Hz. The sounds heard most keenly by human ears are those from sources vibrating at frequencies between 1000 and 4000 Hz.

The first step in hearing is the entrance of pressure waves into the ear canal. These pressures, or sound waves, are transmitted to the eardrum. This thin membrane bows inward under the pressure of the sound waves. The extent to which this membrane moves depends upon the force with which the air molecules hit it, and it is related to the loudness of the sound.

The second step of hearing is the transmission of sound energy from the tympanic membrane, through the middle ear cavity, and then to the fluid-filled chambers of the inner ear. The total force of the tympanic membrane is transferred to the three ossicles in the middle ear. At the end of this bony chain the sound energy is transmitted to the oral window, a thin membrane that connects the ossicles of the middle ear to the inner ear.

The mechanical vibrations are translated into electrical signals within the organ of corti in the inner ear. This organ is a collection of about 23,500 sensitive receptor cells which transduce sound energy into action. The organ of corti is located along the top of the basilar membrane. The basilar membrane stands as a thin and stiff organ near the oral window at the beginning of the inner ear. It progressively becomes larger and flabbier as it descends down to the wall of the cochlea. Lying like a flap over the organ of corti is the rectorial membrane. These two membranes are divided from the rest of the cochlea by the Reissner's membrane and are bathed in a fluid called endolymph.

The cells in the organ of corti are lined with small hairs. These hairs stick out through the rectorial membrane. As sound vibrations enter the inner ear they cause these hairs connecting the two membranes to bend and it is in the bending of the hairs that the conversion from mechanical sound vibrations to electrical impulses occurs. The bending of the hairs triggers an electrochemical reaction in the cells and the generation of electricity. According to Chedd (1970),

> What happens to the sound remains a mystery. All we know is that it is encoded in spikes of electrical activity as each hair cell fires, but the nature of the code is unknown. The unravelling of this code is complicated by the fact that the hair cells continue to fire even in the absence of sound. (p. 29)

Since the fifteenth century scientists have debated on what constitutes a sound. If a tree falls in the forest and no one is there to hear it, will there be sound? The answer of course, depends upon whether sound is to be considered a physical vibration transmitted through the ear, or just a sensation inside the mind of the listener. The first statement is the cause and the second is the effect. As a sound receptor the ear gathers sounds, manipulates them, and processes them to the brain to be decoded just like the eye gathers, manipulates, and processes sights.

Sound has power. It actually represents a flow of power from one place to another, a flow that can be modified by the medium through which it travels. If the sound elicits a response from the organ of hearing then that sound is an effective stimulus. If the sound goes undetected by the ear then the stimulus is ineffective. Effective sound stimuli travel through the ear and to the brain where we become aware—we perceive—the sound as having occured.

Sound adds new dimensions to the sense of sight. It has the power to alter such emotions as joy, terror, love, hate, etc. Most importantly sound forms the basis of speech, our most powerful means of communication. However, the emotional or psychological effects of sound vary depending on each individual's taste, mood, and conditions under which the sound is being heard. Although sounds can produce certain common behavioral effects tests have shown that each individual provides his/her own interpretation of sounds. This factor is grossly overlooked by commonly used television measuring devices.

The Perception of Acoustic Space

The perception of acoustic space, which examines the issues of sound localization cues, distance, and direction judgments is of great significance to the study of television aesthetics because the television image constructors must work effectively with television audio equipment, microphones, turntables, audio consoles, etc. Mastering television audio techniques is a slow process which first requires thorough understanding of the perceptual process of acoustic space.

It has been established that because we normally hear with two ears, we can locate sounds in space in a manner "analogous to the visual depth perception and angular acuity that we process within the two eyes" (White, 1975, p. 125). Our two ears permit us to determine the horizontal angle between the line pointing to the two ears and the direction of the incident sound. The perception of the direction of the vertical angle is poor (White, 1975).

Experiments in sound localization have attempted to discover the specific physical sound cues available to the listener and their nature (Gulick, 1989). To be able to localize sound sources is considered to be the most important ability in a person because it helps to recognize the direction of the objects to look for or to avoid.

According to Moore (1989), "The term 'localization' refers to judgments of the direction and distance of a sound source. Sometimes, when headphones are worn, the sound image is located inside the head" (p. 194). In some cases not only are we able to figure out the direction of the sound source but we are able, somehow, to estimate the distance. This ability is most prominent in blind people. Their survival depends on fine acoustical interpretation as they cannot see where they are going. Their ears do the seeing for them. Blind people can use information from echoes and sound reflections to determine the position of the objects in the environment.

Among the sound cues that enable us to localize sounds in our environment are the proximity of the sound to our ear, the inequality of the intensity from one ear to the other, and the minute difference in the time arrival of the sound. For example, for low-frequency tones the difference in phase is the cue for localization, whereas for higher frequencies it is the loudness that allows us to localize the sound. Sound sources located in one side of the head reach the nearest ear before they reach the other. This delay is measured in a fraction of a second but the ear is so sensitive that it records the discrepancy and interprets it as sound coming from a specific direction.

Sound localization is harder for sounds that are situated directly infront or behind our heads. There are no cues because both ears receive the same information at the same time. It is in these instances that the skills and active imaginations of the television sound engineer are required the most because in television it is important, aesthetically, to match the sound levels to the direction and distance of the action.

An important aesthetic principle to be considered when we try to match the sound levels to the direction and distance of the action is the figure-ground relationship and its perspective. The figure-ground relationship in the case of sound concerns itself with the determination of important sounds as figures, or foreground, and matching these sounds to the background. For example, there is, on a set, a couple sitting in a cafe whispering thoughts to each other. On a long shot the visual aspects of the waiters and other people talking near the couple are equally prominent, therefore,the couple's voices can be mixed with the others. On the other hand, in a close-up of the couple a clearer visual figure-ground relationship is established. The couple will stand-out from the other people, therefore the sounds must be accordingly matched.

The perspective of sound parallels that of the signals. It concerns itself with mastering the close-up shots with close (foreground) sounds and the long-shots with farther away (background) sounds. This practice is not always considered in television programs and the entire aesthetic quality of such programs suffers considerably.

Sound and Noise in Television Images

It has been established that sound is the motion or vibration of an object. This vibration creates disturbances in the surrounding medium (i.e., the air) causing atmospheric particles, or molecules, to be either squeezed closer together than normal, an action known as condensation or to be pulled farther apart from each other, an action known as rarefaction.

Noise and sound are both audible vibrations of the air. The distinguishing factors between the two are in the control, the purpose, and the organization. Sounds have purpose and they are organized. Noises are at random and unwanted. Sounds can be controlled. They can be switched on or off at will and regularly, on the other hand noise is uncontrollable sound.

Noise pollution has become an environmental problem in contemporary society which has created noise through its technology and has tolerated it with only little attempt to control it. Some observers believe that "noise as an environmental pollutant has recently become an object of serious social concern" (White, 1975, p. 179). Over a long period of time very intense noise in our society will cause gradual nervous or mental illness and loss of hearing. These damages occur mostly to people working in industrial jobs such as construction, metal working, and those near busy airports. The visual communication media are also sources of noise when their sounds are abused.

According to Zettl (1990), "Television is definitely not a predominantly visual medium; it is an audio-visual medium. Silent television is inconceivable from an information, as well as aesthetic, point of view" (p. 335).

Consequently, the successful perception of a television picture depends on the proper structure and control of the picture/sound combination. Auditory and visual perceptions must be organized in the same manner; they must be properly and simultaneously combined so that they may form a synergistic structure. This is not always easy to achieve and each case has its own requirements. Research has shown that the matching criteria for pictures and sounds, that is, the ability to simply perceive pictures and sounds together as a unit, can be grouped under such umbrella categories as historical, geographical, tonal, overtonal, and structural (Zettl, 1990).

The various efforts to improve the sound quality of commercial television programs by introducing stereo television sound have had negative, aesthetically speaking, results. The high quality sound does not improve, but rather diminishes, the low definition of the conventional television pictures. When watching a rock concert on television and listening to it through the FM radio channel the results are disappointing since the high quality sound diminishes the low definition picture of commercial television. However, the advent of High Definition Television will match perfectly the high quality of stereo television sound when the new medium will be universally introduced (Metallinos, 1990).

Since it is the sound track that lends authenticity to the picture and not the other way around television image constructors must be cognizant on the various factors of auditory perception mentioned above.

Vision in Motion: The Perception of Moving Images

The visual communication media of film and television are called kinetic (Greek, meaning movement) media because they present signals and sounds in motion. Film and television pictures are moving images. The study of the perception of movements of the television images, both visually and acoustically, provide significant knowledge in the study of television aesthetics. In fact, the study of motion in televised images touches all three axes, perception, cognition, and composition, of television aesthetics.

Although the present brief introduction of vision in motion deals mainly with the perception of motion, visually, it should be pointed out that there is a substantial body of research dealing with the auditory domain of motion as well. Studies which integrate these two domains provide a valuable holistic approach to understanding the perception of motion. For the purpose of clarity and direct application of issues pertaining to the television medium this introduction is limited to the visual domain of the perception of motion. Specifically, in this section such major topics as (a) general theories on the perception of motion and the movement of the observer, (b) real movement and apparent movement, and (c) the generation and the perception of movement in the visual field, will be discussed.

General Theories on the Perception of Motion and Movement of the Observer

The perception of motion has traditionally been treated as a troublesome subject among perception researchers. Initially, the camera formed a basic analogy to the perception characteristics of our organic eye. To the researchers, the optic stimulation of the retina was essentially similar to a static two-dimensional projection of the interior back wall of the camera. Some general observations from this phenomenon formed the bases for the initial theories of visual perception. With the advent of motion perception and the many questions surrounding it, the answers were formulated on the acceptance of the sequential series of static images. It was the limitation of this application which led to the inadequacy of explanations and even caused subsequent obstacles to motion perception comprehension and further delayed the inadvertent progress of research of this phenomenon.

It was the view of some researchers (Cutting 1986) to categorize perception into external presentation which is the information about objects and events, and into internal representation which is based on the cognitive science research. It is interesting to note that the perception of motion has been of interest not only to contemporary researchers in the psychophysics domain but throughout the centuries to men of sciences as well as philosophy and the arts. Starting with this historical concept of perception and metaphysics we can see why we perceive things as we do. Koffka (1935) and Gibson (1950) were the pioneers in this quest. They both understood the perception to be based on the process of picking up or absorbing information.

Such information, however, had to be derived from somewhere and it was Gibson (1979) who proposed, only recently, that such information comes from the environment during a given perceptual act. This information is processed according to the principle laws of optics and perspective geometry. Ullman (1980) also investigated the nature of three-dimensional solutions from two-dimensional projections of objects in motion in the belief that the eye and the camera are compatible. Recent researchers, however, do not share these views since the eye does not have a shutter or an exposure time and it cannot see or record a moving image the same way the camera does (Berleley, 1988, Pong, Kenner, & Otis, (1990).

The most common area of investigation relating to the movement of the observer is called the motion—parallax. It refers to the relative displacement of objects due to the observer's change of placement first analyzed by Euclid in the fifth century B.C. and then by German physiologist and physicist Helmholtz (1821-94), who had observed the effects of the movement of the observer on the perception of distance. What happens to the observer when he/she is moving is that he/she will continuously fixate on a particular point of reference and his/her image will remain stationary on the retina during a brief period of time. At the same time, images of objects that are further and/or nearer will shift in opposite directions over the retina surface. Actually, the points that lie further away than the reference will appear to move in the same direction while the objects that are closer will seem to move in the opposite direction.

Real Movement and Apparent Movement

In order for motion to be visually perceived there must be a displacement of an image on the retina. Berleley (1988) indicated that there can be three different manners which bring about this displacement, (a) the movement of a real object causing the displacement on the retina, (b) when eyes follow a stationary object, and (c) the displacement of different objects or shapes from each other. Johnson (1975) describes such stimuli through the dimension of speed and the direction of movement. According to Johnson (1975) the speed is given in degrees of visual angle per second and the direction is usually given in polar coordinates.

Pong, Kenner, and Otis (1990), have studied the perception of real movement through the analysis of stereo and motion cues in preattentive vision processing by using random dot stereographic image sequences. Pong et al. (1990), explore the relationship between such cue optical flows as stereo disparity, accretion, and deletion of image points.

In similar fashion to real movements, where there is displacement of the image of the retina, a perception of movement can be obtained through sequential displacement of this retinal image even though no movement occurs. What this effect accentuates are the temporal characteristics of the visual systems. Most studies which deal with this topic focus on the determination of the threshold magnitude that will result in the perception of apparent movement. The criteria identifying the visual substrates of visual perception can be studied through direct methods which are most commonly used or through indirect methods which are mostly behavioral, comparing humans and primates.

Apparent motion is a frequent phenomenon which includes film and television and which constitutes the major discussion in cognition and composition. Initially though, the principle of apparent motion was studied by Korte (1983) and by Neuhaus (1983). Their results were inconclusive or simply not accurate although their research was headed in the right direction.

Recently Antsis (1990), published interesting experiments in which he demonstrates motion aftereffects from a motionless stimulus, yet another indication of apparent motion. He accomplishes this through the dimming or brightening of static light or dark bulbs.

Mather and Anstis (1985) have studied the correspondence problems relating shape information within moving images and motion information between pictures. The correspondence problem refers to a succession of images shown rapidly one after the other so that apparent motion is perceived if the two pictures are sufficiently similar. But how similar must they be? Ullman (1979) has labelled this task the correspondence problem. Mather and Anstis (1985) then investigated what happened when the criteria of similarity and proximity were placed in experimental conflict.

Scientists are still not clear as to how real and apparent movements are generated. The mechanisms for processing the perceptual information structuring from real movement is not easily distinguishable from that of apparent movement (Green & Grunnan, 1983). More recent findings by Badler and Tsotsos (1986) suggest that real and apparent movement are processed at some stage by two different perceptual mechanisms.

As with most other present day scientific endeavors perception of motion research has offered us two basic thrusts. Through great technological innovation and an immense amount of observations hypotheses and theories have been generated. For the most part, it has been enlightening—providing a clear understanding of the motion phenomena. Yet such studies do not relate and they are not at all complimentary to studies in other fields. For example, the film and television viewers' perception and comprehension of moving images is rarely discussed in scientific journals, other than those found in the communication field.

The Generation and The Perception of Movement in the Visual Field.

Gibson (1979) is the most prominent among the scientists who managed to narrow the gap separating the moving image makers and the visual communication media scholars, from the perceptual psychologists and neurophysiologists. Gibson (1979) recognized both the need for special attention to the studies of the visual communication media of film and television and the need to combine such efforts involving experimental psychologists and movie makers. According to Gibson (1979),

> The progressive picture [film and television] displays transformations and magnifications and nullifications and substitutions of structure along with deletions and accretions and slippage of texture. These are the "motions" of the motion picture, as I put it in Chapter G. They are thoroughly structured with meaning. They are lawful, even if not described by geometry. They can show people, animals, objects, places, and events with the utmost precision and elaboration. They need to be studied by experimental psychologists on the one hand, and by experimental movie makers on the other. They cannot be usefully studied by taking the parameters of "motion" and plodding through the systematic variation of the traditional experiment. But on the other hand neither can they be understood by playing around with aesthetic intuitions. (pp. 293-294)

This paper is supports Gibson's (1979) plea for cooperation and mutual understanding of the scientific and artistic domains for the development of the field of television aesthetics.

Other supporters of this notion prior to Gibson (1970) were Arnheim (1969), Kepes (1944), Moholy-Nagy (1947), and later on Zettl (1990), Tiemens (1976), and others. Their works have brought closer together the two domains—science and art—and they have put the foundation to the study of television aesthetics as a unique academic discipline. Zettl's (1990) major works, in fact, constitute a direct response to Gibson's (1979) suggestions and constitute the bases for television aesthetic research.

The perception of motion in television pictures is closely related to the concepts of change, space, and time. In the small visual field of the television pictures we observe changes from one field to the next, sometimes very rapidly, often twice as slow; we also observe changes of the environment, the space, the ground of the picture. We experience or we sense the passing of time as it relates to relocation of space or to the speed of motion of the visual elements. We can slow down the motion of the visual elements (objects,_subjects, events, etc.) within the frame, we can freeze the motion, or we can fast forward or accelerate the motion. Each of these motions of the moving images of the television pictures have their own aesthetic value which is determined by the moving image maker's own judgment.

To objectify such spontaneous decisions by the television directors and for the purpose of developing the guidelines—the rules of composition of moving images—the various motions that occur in the television screen need to be examined. Zettl (1990, has identified three such types of motions which occur simultaneously on the screen and he describes them as follows,

> Primary motion is event motion. It always occurs in front of the camera, such as the movements of performers, cars, or somebody running. Secondary motion is common motion, such as the pan, tilt, pedestal, zoom, dolly, truck or arc. Secondary motion includes the zoom, although only the lens elements, rather than the camera itself, move during the zoom. Still, aesthetically, we perceive the zoom as camera-induced motion. Tertiary motion is sequence motion. It is the movement and rhythm induced by shot changes by using a cut, dissolve, fade, wipe, or any other fancy transition device to switch from shot to shot. All three motions are important factors in structuring the fourth dimensional field. (pp. 272-273)

In summary, an understanding of the perception of moving images discussed here in terms of (a) general theories of the perception of motion and the movement of the observer, (b) real and apparent movement, and (c) the generation and the perception of movement in the visual field are prerequisites for the scientific study and the development of television aesthetics.

Summary and Conclusions

In this paper an effort was made to (a) isolate, (b) briefly discuss and (c) clarify the major perceptual factors in the study of television aesthetics, stating, at the outset, that television aesthetics constitutes the first axis in the study of television aesthetics—the other two being cognition and composition.

The first section of this paper provided an introduction to the study of television aesthetics and a review of the literary sources in both perceptual psychology and the arts which constitute the bases for the study of the field of television aesthetics.

The second section provided a discussion of visual perception related topics such as visual stimuli, the perceptual process of television images, central and peripheral vision and television images, the perception of elements within the visual field, and the perception of holographic and three dimensional elements.

In the third section of this paper such auditory perception related topics as auditory stimuli, processes and mechanisms of auditory perception, the perception of acoustic space, and sound and noise in television images were briefly examined and exemplified.

The vision in motion section of the paper provided a review of the general theories on the perception of motion and the movement of the observer, discussed real and apparent movement in the visual media, and examined the three types of perceived motion—primary, secondary, and tertiary—in the visual field, the television screen.

The entire discussion on the perceptual factors governing the field of television aesthetics generates the following concluding remarks:

1. The development of the field of television aesthetics greatly depends on the knowledge and research findings of various scientific studies, found mostly in the fields of neurophysiology, perceptual, experimental, and cognitive psychology.

2. For the study of television aesthetics the understanding of the processes involved in the perception of all three domains, visual (sights), auditory (sounds), and kinetic (motion) is paramount.

3. The need to bridge the gap between scientific research findings on perception related variables and artistic experiments in the visual communication media—primarily film and television—is long overdue and extra efforts should be made towards that goal.

of SPIE- The International Society of Optical Engineering (pp. 100-106), 3, Three Dimensional Imaging, Geneva, Switzerland.

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Preparing Effective Training Videotapes

David Gallup
Robert E. Griffin

Video appears to be the medium of the day. Whether it is used at home, in the classroom, or on the plant floor, videotape is typically the way we are entertained, informed, or trained. So what is the problem? Videotapes today have the capacity to contain special effects, stylized graphics and shooting, lighting and acting techniques can add cost to the videotape production and cause visual interference for the program viewer. This visual interference detracts from the message conveyed.

Why does this happen? Our contention is that most videotape producer/directors do not have a training background. Too often they are not aware that a training videotape is designed to provide knowledge, demonstrate a skill or change an attitude. Too often they forget that training is practical, not glitzy. What can we do, as training program designers, to ensure that we get the videotape based training product we want at a price we can afford? There are four key considerations:

1. Define the training objectives.
2. Develop a realistic treatment.
3. Write a "shootable" script.
4. Shoot with the oral and visual message in mind.

This paper briefly describes the first three considerations and deals in-depth with the fourth consideration. The paper is written from the perspective of a training program designer using professional production houses to produce videotape-based training programs.

Define The Training Objectives

Objectives are the element that drives the video production. The objectives act as a guide to the audience, but also as a guide to the instructional designer and production team.

Designers should specify objectives that state in observable terms what trainees:

- will know about.
- will be able to do.
- will think or feel about a particular topic or subject matter.

These objectives must be stated clearly and agreed to by all members of the training program design team.

Develop a Realistic Treatment

Designers must develop a treatment around the factors of time and money. A treatment specifies how the subject matter will be presented. It outlines the storyline and specifies the talent (narrators or actors/actresses) in terms of attitude, age, gender, and physical description. The treatment typically includes a description of the scenes to be shot, scene locations and sometimes sample dialogue.

There are many ways of producing videotape-based training programs today - from hiring state-of-the-art production houses to doing it yourself with basic facilities and equipment. In-house production time and prices can vary greatly depending on the equipment, facilities and the people that must be hired. Some guidelines developed from using professional production houses to produce videotape-based training programs are:

- For shooting time with a professional production house, we get about 6 minutes of useable footage from a 10 to 12 hour shooting day. The total number of shooting days can be determined by estimating length of the finished programs using this formula.
- The off-line edit can be expected about 5 working days after the shoot; the final edit in another 5 working days.

There seem to be three rules for estimating videotape development and production costs if you are using a professional production house. The minutes are calculated on the completed screen minutes.

1. **$1,500 a minute rule**. This rule can be applied to videotape-based training programs where there is no on-screen talent. The dialogue is provided as a "voice over"; you see a visual image and hear someone explaining what is going on.

2. **$2,000 a minute rule.** This rule can be used to estimate videotape productions that have on-screen narrators but "cut away" to vignettes that illustrate what the narrator is describing. In the vignettes that actors may or may not be speaking; they may just be acting out what the narrator is describing.

3. **$2,500 a minute rule.** This rule applies to videotaped-based training productions that involve contact, on-screen dialogue between talent.

Write a "Shootable" Script

Script writing can be one of the most difficult parts of this process. You should write a script specifying a minimum amount of camera direction and a maximum amount of dialogue. Unless the writer is also serving the producer/director and intimately familiar with the locations where scenes will be shot, specifying detailed camera shots and moves is usually a waste of time. The most useable shots will be selected at the production site. The producer/director will work with the Director of Photography or cameraman to get the required shots. Our experience is that a good producer/director sees the shots in his "mind's eye" before shooting begins and modifies the shot once on location. The dialogue for the talent must be written the way people talk!

Shoot with Oral and Visual Message in Mind

The message must be clear and easy to hear. The actors must deliver their lines in a manner that allows them to be heard clearly. Program participants will soon "tune" out of a program they cannot hear either because of oral or visual distractions.

The visual message must be clear. There are some items to pay attention to when creating the visual message on videotape. These items include:

- Acting
- Camera and movement location
- Continuity
- Graphics
- Location/set design

When these items are addressed properly they don't cause any distraction and are part of the normal visual "flow" of information. When these items aren't addressed properly, they can distract the visual message.

1. **Acting**. Many times the selection of talent presents a problem: Should I use professional talent or employees who know the subject matter and work for the company. Many times the answer to this question is connected to the issue of money; people believe that professional talent is expensive, employees cost "nothing". Unfortunately, this is almost never true. Professional talent are actors and actresses who can deliver a behavioral message through many different "takes", last minute dialogue changes and under trying circumstances. The company employee, while usually knowing a great deal about the subject matter can present a visual problem from three aspects. First, sometimes being recognized on the screen causes viewers to laugh, point or tell stories about the person they are seeing. Second, the dialogue delivery from the a company employee can be forced and unnatural to the point where viewers tune out the message. Third, employees may have a difficult time with memorization, as a result extra shooting time may be required. Our suggestion is to use professional talent in major roles whenever possible, use company employees as "extras" or assign them minor speaking parts.

2. **Camera Movement and Location**. through the use of a zoom lens and a dolley, the shot selection available is almost infinite. From a visual point of view, the

biggest problems come from too many zooms, too many dolley moves or too many pans or tilts. Our suggestion is to avoid over using any one camera movement technique. Keep in mind the basic shot sequence of long shot, medium shot, and close-up. Also keep in mind basic camera positioning. If you want to treat a consistent "equal" visual, keep the camera at the same height; if you want to build up or emphasize one character, lower the camera angle and shoot up at the talent, conversely, if you want to de-emphasize or diminish the role of a character, raise the camera and shoot down at the talent.

3. **Continuity.** Lack of continuity is another item that must be watched throughout the videotape production process. Because videotape-based training programs are not shot in sequence the continuity gremlin is always waiting. Any lack of continuity has the potential to contribute to visuals interference, wardrobe, background, talent hairstyle or weight, lighting or stage direction are some of the major items that cause continuity problems. Our suggestion is to keep adequate records of all visuals; do not hesitate to review footage that has been shot to make sure here is a perfect continuity match between cuts and scenes.

4. **Graphics.** The introduction of unnecessary graphics, or overdone graphics can also lead to visual interference. Again, with the special effects available with computer graphics this is an area that frequently is abused. Our suggestion, keeps the graphics simple; short words visual that appear and leave the frame cleanly.

5. **Location/Set Design.** The location in which you choose to shoot is critical to the overall visual impact of the videotape-based training program. Choices to make are studio or location. If in the studio do I need a set built? If on location, do I have everything I need in terms of physical set up and background? Will the background be distracting in any way, can I control the location adequately? The answers to these questions may help you make the decision between studio and location. Our suggestion is to scout potential locations and visit studios well in advance of making a shooting decision.

Because of the many tools and techniques available to today's training program designer, it is easy to forget the basics of video production and concentrate only on the new techniques and tools. Our intention is to remind readers to rely on the simple basic techniques of production. This technique will lead to the best training program. Many programs that flaunt visual production technique and exceed reasonable budgets, are also at risk in being poor training productions. Today's reliance on technology does not necessarily ensure that we are making good training programs.

Improving Visual Literacy in Television Production Courses

H. Dan Kerns

Television production courses have historically ignored or given little emphasis to the concept of visual literacy in the instruction of material and have concentrated more on the actual button pushing—hands on use of the equipment. The latter is needed, but students need to be more than just button pushers. They need to develop skills and a language in visualization as well as become fluent in the use and knowledge of it.

Many remote video production classes have primarily a photojournalistic approach to using the medium, but oftentimes, students do not have an opportunity to develop one of the most important tools of television production, that being visualization. Certainly most learn the basics of shooting and editing as they complete the required production assignments, but many do not have an opportunity to hone their visualization skills. Several solutions were found to improve the visualization ability of the students. This article will focus on the use of the daily treatment assignment and use of student produced examples and also cinematic examples in teaching visual literacy in television production. But first the question, "What is visualization?" must be answered.

What Is Visualization?

Visualization is the ability to pre-visualize, that is, to mentally see and interpret an event visually, to compose an aesthetically pleasing, meaningful visual, using all the rules and techniques available to construct a visual, which would communicate to the desired audience a message which could in turn be decoded in a manner in which it was intended. All this visualization is done before shooting an inch of video tape. Visualization would also include the ability to transform that visualization into reality on tape. Further, visualization would include the ability to reflect, analyze and evaluate the impact of the total message—much like we do in other communication endeavors. Photojournalists must continually challenge themselves to see things slightly different than they did yesterday, be better today in bringing events and angles of the story to the viewer that they might normally not see or have thought of. This can only be accomplished if this last step of visualization is completed.

The "how" of the transformation (which includes manipulation in post-production editing) is covered in great detail in most television production courses while not enough emphasis is placed on the visualization aspect. Not teaching visual literacy in television production courses is akin to not teaching techniques in drafting blue prints in construction courses. How can students construct visual messages unless they know and use the language of visual literacy. There needs to be a shift in thinking in television production courses to include teaching visual literacy as well as the extensive button pushing.

We Have a Need, Now We Need A Solution:

The mechanics of recording and editing an image is oftentimes the easier part of television production, but the fundamentals of visualization need to become just as ingrained and intuitive. The photojournalist doesn't necessarily have time to think about why he is composing a shot as he does, but does what the shot calls for— almost automatically, but yet creatively. How can instructors move a person who lacks the necessary grammar of visual literacy to the point of knowing the language and then, finally, becoming fluent in its use?

One simple solution at first glance would be to up the number of projects students would do. Logic would dictate that the most useful assignment would be hands on equipment use. Although very important, these assignments offer limited experiences because of several considerations—chiefly a time limitation (one semester), number of students in the course (16-20), quantity of equipment for both field and post-production, and other subject matter of the course (technical aspects). Given these limitations, the students in my video production course still produce six video assignments. In an effort to expand a students' creativity and visualization skills beyond those six assignments a daily treatment exercise can be assigned.

The Treatment:

The treatment is an assignment which requires students to read the local paper and clip an article they feel is interesting and write an overview of how they would cover that story as a photojournalist for a local television station. First they decide the commitment of the story which includes: What is the story? Why tell the story at all? A statement of commitment would answer the questions above and could even be constructed as a fill in the blank type format as the following: My story is:____________ which is important because:________. The second part is deciding the angle and what format the story will take (package feature, etc.). Detailed and specific descriptions of the types of shots the student would include in the story are necessary. Questions such as the following are answered: What video would they lead with for an establishing shot? What would be shot as a close-up? Medium shot? Long shot? Why? What camera angle would be best? How would the visual be framed? Lighting considerations? What type of sequencing would they employ, if any? What kind of cutaway would they look for? What kind would be best for this story? Who would they interview?

A total of twenty-five treatments could be required over the course of the semester. Treatments should be returned on a daily basis with comments, feedback and suggestions as to aspects of visualization they had not considered as well as positive feedback about their development and use of their visualization language. Well-done treatments should be commented on in class throughout the course of the semester.

Analysis of Treatments:

There is at least one very definite drawback to the treatment assignment. It becomes a very time consuming grading exercise if done well. Extensive feedback is necessary, especially at the beginning stages of the course. As the semester continues, the treatments progressively get better and better, which requires less time, but the use of the word less might be a bit misleading—it's still time consuming, but worthwhile.

This daily assignment helps reinforce the intuitiveness of the students' visualization skills and this is reflected in their hands on productions.

By Example:

There is a cumulative bang effect at work when using examples. Semester after semester, the projects are becoming better and better primarily because students see samples of some of the best work for each assignment from the previous semesters. The class discusses how the project accomplishes (or sometimes doesn't) its goal of being a good visual communication piece, how the elements of visualization are successfully incorporated and what end effect those elements have. The student soon becomes capable of differentiating between good, compelling video, analyzing the shots used when, why and for what effect, critiquing the video productions based on the visual language they have acquired and, more dramatically, incorporating the newly acquired visualization skills into their productions at a faster rate than the students before them. There is also an unspoken challenge or prevailing thought that surfaces in the form of "Oh, that's what they did, but I could do that assignment much better myself..." The students use their fledgling language and skill and do just that—produce a better overall production themselves.

Analysis of Example:

By showing the work of prior students, they see what someone of like-skills is capable of doing, using the same equipment they will be using. The goal is also to lay the foundation for reflecting, analyzing and evaluating the work of others and eventually their own. This last item is a very important one in my definition of visualization or visual literacy—that is the ability to reflect on what type of impact their message is having on the receivers.

Cinematic examples are used in the introduction of terms and analysis of the various visual aspects to be stressed. Clips of classic films (*Citizen Kane, Battleship Potemkin, etc.*) are used to illustrate that what is being taught isn't really all that new (and hopefully spark an interest in renting the video if they have not viewed the films before).

Summary:

The course's goal of having students grasp the fundamentals of video production and visualization skills and demonstrate their proficiency is met in a large part by the use of the treatment assignment and explaining by showing examples. A strong fundamental foundation of video production techniques and development of visualization skills and language necessary to produce visually creative and literate individual has been built. The student is not limited to "just gathering pictures" for the evening news, but will have a broad based background which will enable the student to utilize his/her talents in a plethora of creative endeavors and job opportunities — not to mention the ability to decode others' visual communication messages.

The use of the treatment assignment and teaching by using examples is just a couple of the ways to reduce the cognitive dissonance created by sending students out of class not visually aware, not visually literate (not that all students who leave class are visually literate, but the effort is there). Is it working? I think so. Is there a better way of integrating visual literacy into television production courses? Probably. This is just one way of integrating visual literacy into video production courses. It has been successful and these methods will continue to be utilized. However, the search and exploration for new and better ways of incorporating visual literacy into courses should always continue.

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Fall 1991

ASSIGNMENTS:

50pts--VO pack# 60 sec. , news anchor lead-in and voice over script required.
100pts--Studio-pack# 2 min., sound bites, story information, and anchor lead-in. Script required.
100pts--Commercial 60 sec. script required. Individual project.
100pts--Feature# 2 min., package, must shoot, edit and script pack.
100pts--News Event* package based on a staged news event. Work in 4 person teams. Must shoot, edit and script pack for "air" at the end of class period.
50pts--Editing Quiz will be a package you develop from file footage and information provided to you--lenght will vary depending on story picked.
50pts--Treatments--see below
#work in teams of two
Other assignments are possible. These may take the form of pop quizzes.

REQUIREMENTS:

Supplemental Reading: *NewsTalk II* as assigned.

PJS Subscription: You must subscribe to the Peoria Journal Star and read the newspaper in an attempt to gleam out possible leads for a news or feature story. We will discuss the stories and leads each period. Also have written down the "treatment" you would give the potential lead. The stories should be cut out and taped to the back of the treatment. **At least** one lead per class meeting --you will need a total of 25. This does figure into final grade.

Become a consumer of the medium: You should watch at least one LOCAL and NATIONAL newscast daily. You may pick which of the three channels you wish to view. If you capture on video tape an interesting story you have viewed, please feel free to bring it in and we will view and discuss it (or if you just saw a news report--bring up the subject for discussion).

PARTICIPATION IS A MUST! ATTENDANCE IS A MUST!
Assignments must be turned in at the beginning of the class period which they are due.

NO LATE ASSIGNMENTS WILL BE ACCEPTED FOR A GRADE. You must complete all assignments in order to pass the class. Emergencies will be handled at the discretion of the instructor.

NO MAKE-UP TEST DATES. Only prior permission and in some cases emergencies will the student be able to make-up the test. Again, all decisions will be handled at the discretion of the instructor. Pop quizzes are possible.

GRADES: Grades will be figured on a percentage basis:
90-100% A--**EXCELLENT** --top notch production, no/very minor mistakes
80-89% B-- **ABOVE AVERAGE**--good creative production, made minor mistakes
70-79% C--**AVERAGE**--you did fairly well, made some mistakes--learning the ropes
60-69% D--**BELOW AVERAGE**--did the required work, need to improve in some areas/aspects of television production if you hope to stay in this business.
below 60% F--**SUBSTANDARD WORK**--did not do the required work--very deficient in areas/aspects of television production.

This is a labor intensive class, working long hours on a single production will not guarantee a good grade (although it may help). Only a quality production, strong production and writing skills, creativity, the ability to work well with others and a mastery of equipment will result in a good grade. Please note the descriptions next to the grading scale above. This is what I look at when grading a project.

Equipment and Facilities: Camcorders may be reserved for one usage at a time at AV Services (ext. 2332), Room 5. Equipment may be checked out for a limited period of time depending on availability. Generally, equipment can be reserved and picked up from 9:00am-12:00pm, 1:00pm - 5:00pm, 6:00pm - 8:00am the next day. Equipment taken out on the weekend must be picked up on Friday afternoon (4:00 or 5:00) and returned on Monday by 8:00am. (During the course of the semester, we may switch the check out procedure to suit the needs of the class, projects being worked on, etc.)

Editing booths are located in Bradley Hall and may be reserved for a one time usage at a time. One usage will consist of four hour time blocks maximum. The booths will be available Monday - Friday at designated times. Their will be student assistants to answer questions.

EQUIPMENT RESPONSIBILITY OF THE STUDENT:
You are responsible for the equipment you check out. You will be required to pay any and all fines for overdue equipment, lost or damaged equipment.

You can only use equipment owned by the University and designated for use in this class and available to all students equally.

You fees for this class include the purchase of one video tape which is yours to keep. Additional tapes are available through Audio-Visual Services.

Special Note: The instructor reserves the right to deviate from the syllabus with advance notice to accommodate unexpected occurrences during the semester.

IF YOU NEED ADDITIONAL HELP--PLEASE CONTACT ME!!

I am more than willing to give additional instruction or help with all aspects of the course. This is a technical class, and for some not used to the technical aspects of television (and even those who are) it can be confusing and difficult. Do not be afraid to seek out addition help from me.

Communication 335 **Fall 1991**
Schedule of Class Assignments and Readings:

8/29	Introduction to course, tour facilities, Read Ch 1, 2
9/3	Begin Unit 1 Visualization of the story, discuss Ch 1 & Ch 2, Read Ch 3 & 4, View Behind the Scenes... ar Analysis of a Newscast HANDOUT: slugline menu, Assignment Sheet and ADI
9/5	`Discuss treatment and commitment assignment (handout) cont. discussion of Ch 1 & 2
9/5	The "How" of Visualization, view *White Balance, One Shot, Covering vs. Interpreting,* discuss videos as related to ch. 2, 3, and 4--old camera demo, begin discussion of Ch 3 & 4, Assignment: treatment and commitment of news clipping
9/10	The "How" con't. view *Camera Basics: Citizen Kane, Macro Shooting, Jump Cuts* cont. discussion ch 3 and 4 in relationship to videos,
9/12	View NPPA Video and discuss as capstone to earlier discussions
9/17	Demonstrate Camcorder and VCR -HANDOUTS 5-7, Overview Scavenger Hunt Assignment
9/19	Hands on in class use of equipment, read Ch 6
9/24	Discuss Ch 6, Demo audio facilities, show examples of effective use of audio in video productionView *Soundtracks* Read Ch 8
TBA*	ADDITIONAL AUDIO DEMO this is optional--I will put up a schedule for any additional audio instruction you might like to receive--*To Be Arranged
9/26	Discuss Ch 8, demo of editing next time--have shot plenty of raw footage--bring tape to class
10/1	**Demo of editing** bring raw video footage to edit HAVE SIGNED UP FOR INDIVIDUAL INSTRUCTION TIMES --NO CLASS MEETING
10/3	Finish Ch 8, discuss editing concerns, overview 1st assignment, visual elements, composition VIEW SAMPLES, Read Ch 5
10/8	Lighting Demo, handout on lighting.
10/10	**MIDTERM**
10/14, 10/15 FALL BREAK	
10/17	go over midterm. History of ENG, from newsreels, 16mm film, to video, View *Inside Story: Newsreels* *NT: 121-134*
10/22	discuss opportunities in Corporate Communication, discuss assignment 2 , Read Ch 7
10/24	Corp. comm. con't. view samples *READ NT: 3-38*
10/25	**VO Pack Due scripts in my mail box--leave tapes in edit area-- 4:00pm**
10/29	Critique VO Packs, Corporate Communication discussion cont. Discuss Ch. 7, Read Ch. 12
10/31	discuss Ch 12 , discuss *NT: 213-226,*
11/5	Show sample studio packs, discuss assignment Discuss *NT: 171-187, 85-101*
11/7	video workshop View Newswomen discuss *NT: 121-134*
11/8	**Studio Pack Due—4:00pm**
11/12	Critique Assignment 2, discuss Commercial Assignment *READ NT: 39-63*

11/14	view sample commercials Discuss *NT 39-63*
11/19	Guest Speaker, News director, resume tapes, expectations, job market, Read Chs. 11 & 13
11/21	Discuss Ch 11, view sports coverage samples, Discuss Feature, show sample features
11/22	**Commercials Due - -4:00pm**
11/26	Critique Assignment, View "Cameras in Court", discussion on ethics Discuss Ch 13, Read Ch 14, Appe C & D
12/3	Discuss Ch 14, Appendix C & D Discuss Ch 15, Discuss News Event
12/5	Review for final
12/6	**FEATURES DUE—4:00pm**
12/10	**News Event Scheduled–Due for airing today**
12/11	No Class Study Day
12/17	12:00 - 2:00pm Final exam, comprehensive, Ch 1-15, Appendix C & D, video programs, and guest speakers,
	Critique feature & news event--in the past this has been at my house--we will vote on date and time I will fix Chili or something...and we'll sit back and view the final projects

Enhancing Visual Communication: Compressed Video as an Electronic Visual Bridge

Ellen O. Edwin
Walter B. Owens
Landra L. Rezabek

Society appears to be enamored with computer games, insistent upon having television, videotapes, and camcorders in the home, and reliant upon traffic lights and billboards for direction. In its schools, society also expects educators to satisfy this visual appetite. Educators have responded by taking advantage of technological options which provide a variety of visual stimuli. One technology that promises to satisfy society's expectations for visual input, yet enhance the goals of educators, is compressed video. Already in wide use by the military, and business and industry, compressed video is being hailed as the "technology of the nineties" (Howes, 1990, p.30).

What is compressed video?

Simply stated, compressed video is the ability to send and receive simultaneous, interactive audio and video signals, using specialized technology, to other sites with similar capabilities anywhere in the world at reasonable costs. It should be noted that compressed video can be sent over fiber optic telephone lines, by satellite, and by microwave transmission. However, when used within the context of this paper, the term "compressed video" will refer to the use of fiber optic lines.

Why use compressed video?

Educators know that engaging students in experiences beyond those of the traditional classroom enhances learning. A variety of media have been used to break down classroom walls and support student interaction with the outside world. Options such as teleconferencing and closed-circuit television have been used to expand students' experiences. Unlike teleconferencing, however, which provides only audio communication, and television which allows only one-way audio and video communication, compressed video allows simultaneous multi-way audio and video interaction among many sites. These sites can be as close as the next door classroom or as distant as a foreign country.

This "electronic bridge" called "compressed video" opens opportunities for students to interact visually as well as verbally with students in the next district, in the next state, in Mexico, in Russia, or in Africa. Instead of just reading about a community or seeing a film about a country, the student can become part of that culture through personal interaction.

New sights, sounds, and people cause boredom to disappear and motivation to return. Students can "attend" and actively participate in classes offered at another site. Educators can share ideas and get feedback instantaneously. Districts can provide in-service training throughout a school system or across a state without paying for multiple instructors. Mentoring of student teachers in locations distant from the supervising faculty can be supported through the use of discreet lines (private microphones in the ear). Teachers can broaden their classroom lesson to include on-the-spot visual and verbal communication with special guests in distanced locales. Parents of special needs students can encourage each other and share ideas without having to travel to a common location. And all of these activities are accomplished with full visual and auditory interaction. The possibilities within the field of education are limited only by the imagination.

In addition to the examples above, compressed video merits attention for its ability to support cooperative learning, peer teaching, and unobtrusive evaluation. David Berliner suggests that "regardless of ability, most students who take a teaching role learn much more than they do when they receive instruction or work independently" (Berliner, 1989, p. 13). Using compressed video, students can become teachers for students at other sites. In fact, students in Wyoming have done just that!

Earlier this year, at the Wyoming Center for Teaching and Learning at Laramie (WCTL-L), fifth grade students taught third grade students over 400 miles away to make kaleidoscopes. The experience was a success from many vantage points and a failure from none. Real-time two-way visual interaction was a crucial component of the teaching-learning experience. Students demonstrated how to make kaleidoscopes, a procedure that would have been virtually impossible to describe verbally. Fifth grade students also used visual feedback and correction to monitor the success of their third grade pupils. Clearly, the visual aspect of the lesson was crucial!

How is a compressed video system configured?

What does it take to set up a compressed video system capable of supporting educational activities in this way? With more than fifteen vendors nation-wide, compressed video systems vary in components, configuration, and cabinet styles. Yet, all systems will have some basic elements in common. All will have one or more monitors (most people call them "TV"s!), one or more cameras (much like a camcorder) and a computer of some make or style (some with familiar-looking "boxes" and others with just the "innards" of the box). Most systems will have a remote control (about twice the size of the one you have at home) and a special kind of overhead projector (usually called a "presenter"). While a system may weigh as much as 500 pounds, all of it fits on a portable cart easily pushed from location to location.

All of these elements then work together using fiber optic telephone lines and a CODEC (whose function will be discussed later).

Fiber optic telephone lines are the life blood of a compressed video system as they connect system components located at different sites. To understand the capabilities of fiber optic telephone lines, consider the ability of the conventional telephone line. It allows two (or more) persons to communicate using audio. Add to this the ability of another line which can provide visual images so that now you can see the person to whom you are speaking. Add to these lines the ability to see motion. Double this combined power and you have the special telephone line that allows simultaneous audio and video communication among as many as fourteen sites at once. This special telephone line is called a "T1" line and is commonly used for compressed video.

The fiber optic lines used by a compressed video system transmit visual information differently than is common when broadcasting television signals. In a compressed video system, computer algorithms prevent the duplication of redundant pictures (pictures where no motion or change occurs from the "frame" of information sent before). So, in effect, instead of sending approximately 30 frames per second, approximately 15 fames are sent over the T1 line because the part of a picture that does not show movement or change is held in memory. The picture in memory is used over and over again until movement necessitates the transmission of a new frame. Thus, less power or capability is required for transmission making it possible to transmit visuals over telephone lines rather than using other broadcast media.

Though compressed video can be sent over telephone lines, the sending and receiving sites must have the same technical capabilities. To use compressed video, each site must have a compressed video system complete with a CODEC, the box that gives the compressed video its special abilities. CODEC stands for "enCOder/DECoder". This box converts the analog audio and video signals to a digital format so they can be transmitted over the T1 line.

Three major costs are identified when using compressed video: the initial installation of T1 lines, the initial cost of the system itself, and the long distance phone calls to other sites whenever they are made. Installation costs and phone call charges will vary. The system components range in price from about $40,000 to over $100,000 depending on the "bells and whistles" that are added. All prices, however, seem to be dropping fast!

Remember, at least two systems are required--one at each end of the telephone line. So, while it may appear that the initial costs are high, the savings in travel costs alone over a year's time could pay the bill!

Who can use compressed video?

You can. A second grader can. The class clown can. The quiet child in the back row can. There are only two requirements for using compressed video. First, users at both sites must have access to the capability; that is, a fiber optic phone line and a "system" (the hardware) must be present. Second, someone at both sites must be able to flip a switch on a power strip and be able to use a remote control. There is no specific age requirement, nor is any intensive training required.

Where can compressed video be used?

The use of compressed video is limited only by the fiber optic capability of your location and by your ability to push the system's cart to your room and to connect the system to a power outlet. With the growing interest in fiber optic networks, soon many communities will have this capability available. Fiber optic phone lines can be installed just as easily as a conventional phone line is "hooked up". In addition to schools, compressed video is easily acquired by government and business offices, churches, public meeting places; even courtrooms can easily

When can compressed video be used?

Once the fiber optic lines are installed and the compressed video system is powered up, the system can be used at any time, day or night, when someone at another site will answer. Compressed video is as readily accessible as your telephone.

What are some benefits of compressed video?

Compressed video can serve as an electronic visual bridge offering a variety of visual options to creative teachers, parents, administrators, media specialists, and students. When visual interaction is necessary, compressed video offers alternatives to more expensive means of communication such as real-time satellite and microwave. When budgets are tight and travel time is limited, participants only have to travel as far as the closest compressed video site to attend conferences, receive in-service training, or engage in electronic teacher-to-teacher sessions.

Whenever visual communication is needed to accomplish a goal, compressed video can be used. Instead of audio communication only, as provided by telephones, compressed video supports interactive visual communication. Many curricular objectives require the establishment of a visual learning environment and the use of demonstrations during lessons.

Compressed video can be used whenever visual communication is vital to the educational atmosphere. Visuals can open rich experiences to other places, other cultures, and other customs. While compressed video can transmit pre-produced visuals, such as slides, stills, and videotapes, it can also bring live images from distant locations.

The advantages that compressed video offers to educators and students make it a viable tool for visual and verbal interactions. Little training is needed by teacher or student to use a system effectively. Once introduced to the system, teachers and students can take advantage of full color visuals and live, multi-way interactive capabilities of the technology. All of these factors work together to make compressed video an effective means for enhancing the educational process. Yet, as with any educational aid, compressed video should be used when it will enhance learning, not detract from it. The challenge remains for practitioners and researchers to more fully investigate educational applications and potential of this electronic visual bridge called compressed video.

References

Berliner, D. (1989). Being the teacher helps students learn, Instructor, 99 (8), pp.13-14.

Howes, K. J. P. (1990). Compressed video: Dial-up movies and long distance conferencing - The technology of the nineties. Via Satellite, September, pp. 30-39.

Visually Different: Does Telecourse Style Make a Difference?

Glenda B. Thurman
Darrell G. Beauchamp

"Distance Learning" is currently a hot topic and subject to much discussion. Given the ability to deliver instruction across time and space, educators have latched on to this "new" media and the proliferation of shows has been incredible. Under the umbrella of "distance learning" one can find various forms of satellite transmission, microwave or ITFS (instructional television fixed service), and the distribution of "canned" courses on a series of videotapes. In most examples of distance education, it is the transportation of information and ideas, not students or faculty, that has made the new medium so encouraging. Previous attempts to deliver instruction long distance have often fallen short of ideal. The difference in today's technological capabilities and previous attempt is that current technology is, for the first time, allowing for true interaction between faculty and student.

Television in general has been both heralded and blasted as a teaching tool for students of the 21st century. Students approve of this method of teaching, and teachers, although reluctant at first, have shown encouraging signs of wanting to learn to use the medium wisely. Depending upon the study one chooses to cite, television, and thus distance learning, has been called both effective and worthless as a teaching medium. One reason many television distance education programs fail is the result of producers who have ignored the concepts of good graphic presentation and preparation. They have traditionally sought to produce "good television" without any attention being paid to the quality of the graphics within that show.

During the spring and fall semesters of 1991 the authors have had the opportunity to evaluate first-hand the production of two distance education productions intended for delivery at a later date. This paper briefly describes those productions, the graphics within them, and ends with a list of questions these authors believe need to be asked during three stages of the production.

An analysis of the separate productions provides the test for the following questions and furnished the authors with the criteria for the evaluation of the effectiveness of the materials prepared for the telecourses.

Production 1.

Production One was a series of videotapes produced to teach a course in speech-language pathology. The instructor taught her class in the studio, requiring that the production crew meet each of the times the class met. The instructor selected supporting visuals for her class with mixed success since she did not understand the difference existing between the printed page and the 3:4 video ratio. The visuals were predetermined by the instructor and captured from various sources: two cameras, character generated graphics of transparencies, slides incorporated via multiplexer, and videotape inserts dubbed into place. The crew for the production were students with at least one year's experience in mass communication. The tapes were copied from the 3/4" format to 1/2" format, duplicated for distribution, packaged with syllabi, objectives, and worksheets. For interaction, the instructor telephoned each student in the telecourse twice during the semester and made available scheduled times for additional phone calls.

Production 2.

Production two was a series of videotapes produced to teach a course in book and media cataloging. Similar to production one, this course was also taught in the studio. The supporting visuals for this production were produced following the class presentations and edited into the video during final editing in post production. Unlike the crew for production 1, the crew for this production had, for the most part, no or little experience in a studio setting (only the directors were knowledgeable and guided the crews). This production series of 20 videos was shot in 2 1/2 days, with crews. Post-production work followed.

Questions for thought

Looking beyond the production quality of the show itself and the transmission mode, the following questions arise as to what underlies effective visual communication in these two education distance courses, or, how well were the instructional events achieved?:

1. Were visuals considered before or after the production of the event?

It is these authors belief that the quality of the graphics for production two was better than were the graphics for production one. Obviously, given the opportunity to study the presentations, see how the materials fit within the lecture, and discuss with the instructor whether or not the visual were even needed was a tremendous boost to the overall quality of the visuals. One thing to watch out for: post-production time is costly, not only in dollars but time.

2. Were ancillary materials included as part of the instructional package, or was the video designed to stand alone?

We found that visuals were often put to better use when sent as part of the ancillary package v being included in the video itself. The instructors in both productions many times included visuals that, although good for traditional classroom, did not work well within the video. Those images were more effective when sent to the student as a part of the package. The authors suggest that the package sent to students be very carefully planned: too little material and the student feels lost, too many extras in the package and the student is overwhelmed with materials arriving all at once.

3. Has the audience been considered in the design, is the approach to broadcast material or narrowcast to a specific group?

For obvious reasons, it makes a difference if a live signal is going out or if videotapes are being sent to students well after the production. This is where prior planning is important.

4. Were the instructional events designed with performance objectives guiding the construction of the content and the visualization?

Again, this is an instructional design question: the better the planning, the better the production.

5. Did the visuals communicate or fail to communicate instructional content?

Looking at the two productions, the authors found very little difference in the final overall ability of the productions to communicate the learning objectives. Study is continuing which will examine the effectiveness of the visuals within the two productions.

Summary

Although the methodology for this study is weak (we openly admit stumbling into the study) it has provided us with some unique insights into world of home-based video production for distance education classes. Future work with the production will be under tighter controls. The authors are very interested in the use of visuals within the productions, and will continue working to better understand them.

A Technique to Automatically Construct How-to-Read Graphics Tutorials

Raymond P. Kirsch

Introduction

The ability to read graphics is an important skill in contemporary society, one that is not normally taught beyond the elementary grades. Educated people are expected to be visually literate and to understand the graphics which today's technological world presents to them with increasing frequency.

Graphics are important for the following two reasons:

1) Effective graphics simplify the expression of data and improve the holistic understanding of information by reducing it to essential elements. This graphical assistance to comprehension is vital because of the volume of data that is being disseminated through the media to the general public as well as the volume of data disseminated through graphical interfaces to computer users.

2) Graphics that reinforce content have been shown to facilitate the learning of that content. According to Bertin (1983, p. 164), graphics create a mental image which reduces the effort required for remembering and processing.

Information disseminators are at a time when they need graphics. Moreover, technology has produced increasing capabilities to generate and deliver graphics to an audience which is visually untrained, an audience comprised mostly of average readers. It is not valid to assume readers understand the pictures as they understand words because society's long-term educational system emphasizes only textual reading skills and assumes graphical reading skills. Now is an important time to educate everyone in how to read and interpret graphics.

The research described in this paper addresses this specific application -- using multimedia technology to teach fundamental skills of reading and interpreting graphics. A system for authoring computer-based lessons on how to read graphical notation has been designed. The lessons generated are tutorials that precede more sophisticated applications which use the graphics to communicate advanced content.

Relevant Background

An investigation of the literature was conducted to determine what fundamental skills are required to read graphics and led to the work of Bertin (1983), Levin (1987), Paivio (1986), and Edwards (1979).

Semiology of Graphics

Bertin specifies graphics as a logical system and describes the processes of reading graphics for understanding (Bertin, 1983). The goal for the reader is to comprehend an overall image. According to Bertin, such comprehension is possible only when the meaning of each constituent object is defined prior to its being observed in a collection of objects. He likens this defining to a mathematical equation's being understood through specification of its component terms. This part-to-whole view of comprehension is a fundamental condition of logical reasoning in which the overall goal is understood through a sequence of rational steps. Graphical comprehension begins with learning the parts in order to understand the whole image.

Graphical representations consist of several components, an invariant and a series of correspondences among the components. The invariant is central to all correspondences. According to Bertin, to study a graphic intelligently means to come to know the correspondences among the components.

Bertin has defined the following three successive stages in the process of reading graphics:

1) Identification of the components and the invariant in general, i.e., in a manner independent of the specific graphic

2) Identification of components and the invariant as they are represented in a specific graphic

3) Perception of a series of correspondences among the components

Bertin has also posited the following three levels of reading graphics:

1) Elementary level in which only single elements or single correspondences are read

2) Intermediate level in which groups of elements or correspondences are read

3) Advanced level in which overall reading of an advanced graphic is achieved. Here the graphic can be read as single elements or as groups of data or as a whole concept.

A key question is -- Given that the goal is proficiency at the overall reading level, how should beginners be taught to read graphics? Bertin says to start at the elementary level and to progress through the intermediate toward the goal of overall reading. Single element reading and rereading is the first step.

Bertin provides two arguments for proceeding in this order. First, complex images offer all three levels of reading and cause beginners to hesitate. Simple images, offering fewer levels, reduce this hesitation. The idea is not to intimidate the reader, and a simple to complex progression is encouraged. Second, according to Bertin, numerous studies show the average person reads at the elementary level and encounters difficulty in adapting to the intermediate and overall levels. Therefore, one should begin teaching the average reader at the level where he or she is familiar (and not intimidated), then lead the reader to more advanced levels.

Psychology of Illustration

Levin (1987) conducted an extensive empirical study showing that relevant graphics facilitate remembering. The Levin report emphasizes that effective graphics must be congruent to associated text, and whenever possible, the graphics should be transformational, i.e., the graphics and text should bear a close resemblance. Transformational graphics were found to be the most effective in aiding retention.

Dual Coding Theory

It is a widely held belief that pictures and words activate different hemispheres of the brain. Paivio (1986) theorized that two independently functioning subsystems allow a propositional representation for left hemisphere verbal, sequential functioning and a separate analog representation for the pictorial, nonlinear right. He hypothesizes that it is the dual encoding of pictures and text that allow pictures to facilitate remembering. He further conjectures that the primacy is for the visual encoding over the textual. Paivio reasons that pictures are dually encoded as images and as propositions. A systematic approach to the teaching of the reading of graphics, designed according to Paivio's theory, should present the image first then follow with congruent text to dually code the image.

Drawing on the Right Side of the Brain

Edwards' empirical study concludes that to be successful at seeing spatial relationships, a necessary condition is the shutting down of the verbal, left hemisphere (1979, p. 56). Without this shutoff, the left-brain tends to dominate and to interfere with the imagination and visual perception. Edward's study is supported by Saint-Martin's study (1989, pp. 303-316). She explains that when words are introduced, perception moves away from the concrete context toward an isolated, discontinuous, and more abstract representation.

Reading graphics involves seeing how objects are related spatially. According to Edwards and Saint-Martin, this skill should be taught by proceeding with the graphics before introducing associated words, otherwise interference may occur.

System Design Criteria

In light of the relevant studies presented, a computer-based system to teach the reading of graphics should be designed according to the following criteria:

1) Presentations should progress from simple to complex.

2) Each constituent object should be presented individually prior to its appearance as part of the whole collection of objects.

3) The skill of reading graphics should be taught at three successive levels: elementary, intermediate and advanced. On the elementary level single components or correspondences should be taught. Groups of components or correspondences should be taught on the intermediate level. The whole graphic is read on the advanced (overall) level and should be taught after the elementary and intermediate presentations are completed. A lesson on reading graphics presents the components, the invariant and a series of correspondences among the

components. These correspondences span all three skill levels.

4) A two-stage process should be applied at each level. The first stage identifies graphical components and correspondences among them in general. The second stage identifies them in a specific example.

5) Use congruous (and, if possible transformational) graphics/text associations to significantly aid the reader in remembering.

6) Design presentations from a visual primacy to encourage dual encoding of information and a left-to-right conceptual shift. Show each picture before associating it with congruous text.

Instructional Model

The system design criteria appearing in last section was used as a basis for searching for an appropriate theoretical model of instruction and led to Elaboration Theory of Instruction (ETI). This model requires that presentations be given in a simple to complex manner. Presentations are distributed across successive levels of increasing complexity. Material is presented first in general then by specific example (Reigeluth, 1980).

ETI offers a canonical form to use in representing all lessons. The model calls for mul-tiple levels. Each successive level adds information to the preceding level or levels. The lesson begins with the simplest elements, then moves to subsequent levels in which elements are elaborated upon.

ETI can model Bertin's three stages of reading graphics. The first level in the ETI model identifies the components, the invariant and single correspondences among the components of the graphic. This ETI level corresponds to Bertin's elementary reading level. Subsequent levels in the ETI model present a series of increasingly complex correspondences among the components that are required in Bertin's intermediate and overall levels.

The ETI model has been recommended as a useful, psychologically-based methodology for the design of computer-based instruction (Hannafin & Reiber, 1989, pp. 91-101). Researchers have recognized the need for a theoretical basis for the design of computer-based instructional systems (Park & Seidel, 1989, pp. 72-80; DuBoulay, 1989, pp. 379-384). The need for psychologically based methodology and the correlation of Bertin's theories with the ETI model lead to the conclusion that the ETI model provides the theoretical framework for a computer-based instructional system based on cognitive theory of instruction rather than on ad hoc sequencing of lessons.

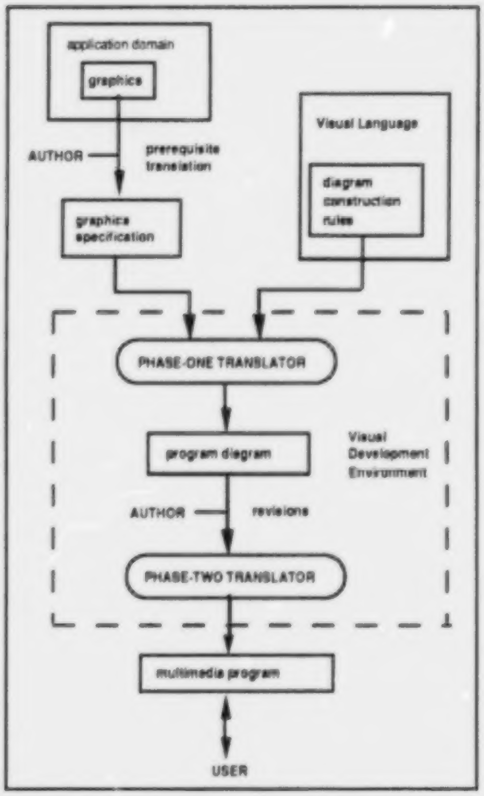
application domain
graphics
AUTHOR
prerequisite translation
graphics specification
Visual Language
diagram construction rules
PHASE-ONE TRANSLATOR
program diagram
Visual Development Environment
AUTHOR
revisions
PHASE-TWO TRANSLATOR
multimedia program
USER

Figure 1. Overall System and its Components.

The System

This system is designed according to the criteria presented above to teach beginning and average users how to read the graphics in a specific application domain. A multimedia presentation that includes graphics, printed and spoken text, animations and simple user dialogs is used to do this. The system and its components, depicted in Figure 1, are outlined in this paper, and are described completely elsewhere (Kirsch, 1991).

An application that uses graphics in its communications with the user appears at the top left of Figure 1. The graphics in this domain are the only inputs to the system. Overall processing consists of several steps to translate these graphics into a multimedia presentation on how to read them.

The prerequisite translation step is accomplished by the author. It requires the construction of a graphics specification. This translation represents the graphics in a manner suited to their presentation in a lesson on reading them.

The visual development environment is activated upon completion of the prerequisite translation step. The graphics specification is input into the PHASE-ONE TRANSLATOR along with diagram construction rules. The latter are part of the specification of the visual language component.

The result of the first phase of translation is a diagrammatic structure expressed in the visual language of this system. This structure is referred to as a *program diagram.* The program diagram which the system automatically constructs using values from the graphics specification, is known as the *basic lesson.* For every graphics specification there can be many program diagrams but only one basic lesson.

Once the basic lesson version of the program diagram is constructed, the author can proceed in one of two ways. The author can elect not to revise the basic lesson. In that case, it is passed along as input to the PHASE-TWO TRANSLATOR. The author can choose to revise the basic lesson form of the program diagram before phase-two translation, producing a different version of the demonstration on how to read the same graphics. The revision process followed by phase-two translation may be repeated.

Phase two translation results in the construction of an executable program in a target multimedia language such as HyperTalk™. The program is made available to the user by linking it with an icon in the application domain. When this icon is selected by the user, another window opens. A multimedia demonstration on the reading of the domain graphics is given in that window.

Advantages of this System

Phase one of the translation process results in several significant advantages over other multimedia development languages and tools. These advantages include the following:

1) A demonstration is automatically generated. There is no need for the author to develop one. .

2) A canonical form underlies all programs. This form is in accordance with an embedded sequencing model. The author does not have to be concerned with the details of overall sequencing.

3) Authoring always starts at the same point. The same form is available for revision.

4) The author is free to explore revisions of the details of the presentation.

An advantage of phase two is that it automatically produces an executable form of the lesson. The author does not have to program one.

Application Area

The fundamental need of multimedia systems is that they communicate in a language understood by the user. Both graphics as well as words must be understood for communication to occur. All computer-based, multimedia interaction must take ease of communication into account.

State-of-the-art multimedia interfaces to advanced applications each have their own particular brand of the components depicted in Figure 2.

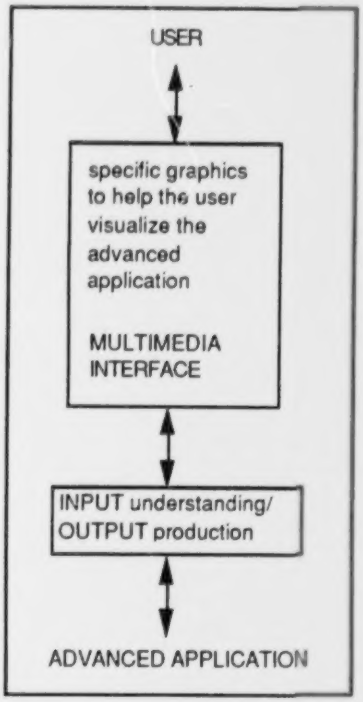
USER
specific graphics to help the user visualize the advanced application
MULTIMEDIA INTERFACE
INPUT understanding/ OUTPUT production
ADVANCED APPLICATION

Figure 2. Typical Interface Components.

These computer-based systems introduce graphical interfaces into sophisticated applications without aiding the users to understand the graphics. It is a mistake to assume that average and beginning users of multimedia interfaces can comprehend the graphics. The system being reported in this paper has identified this fundamental need and filled it. A system has been developed that facilitates authoring of on-line, how-to-read graphics demonstrations.

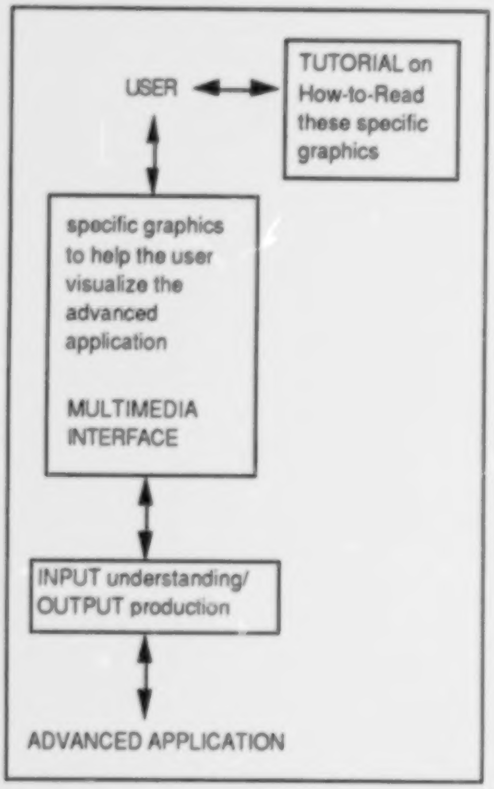
USER
TUTORIAL on How-to-Read these specific graphics
specific graphics to help the user visualize the advanced application
MULTIMEDIA INTERFACE
INPUT understanding/ OUTPUT production
ADVANCED APPLICATION

Figure. 3. Components in the Improved Multimedia Interface.

Figure 3 reflects the improvement which results from the work of this researcher. An on-line, tutorial demonstration is available. The user needing a review of the graphics can request it. After a tutorial on the notations of the specific graphics, the user is more likely to understand the advanced application.

Summary

The system described in this paper provides a paradigmatic model that facilitates authoring of on-line, how-to-read graphics tutorial demonstrations. Computer-based developers will benefit from this. A paradigmatic representation is specified for graphics that are to be presented to the user. The model shows how to use this representation to construct lessons, how to provide a visual development environment and visual programming language with which to produce highly structured demonstrations. These are automatically sequenced on the basis of a canonical, embedded curricular model. All aspects of the system are replete with congruous graphics and text. Every aspect of the presentation appears in a primarily visual manner.

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Use of Visuals to Introduce Computer Novices to Routine Maintenance Tasks

Laurie F. Ruberg
Mary G. Miller

Introduction

The Interactive Design and Development (IDD) group at Virginia Polytechnic Institute and State University (VPI&SU) has developed an interactive video system which provides Extension information in a simple, accessible format for the general public to use. These information kiosks are installed in public libraries, malls, and other highly visible community locations in thirteen sites throughout the state of Virginia. This presentation looks at the visual instruction used to train the personnel at each site in how to handle simple equipment maintenance requirements to support the interactive video systems.

The personnel identified as local site coordinators for IDD's systems represent a widely diverse group with some coordinators having much experience and aptitude with computers and others with little to no exposure to this technology. Thus, the training and support materials for the site coordinators had to be designed for a significant variation in prior knowledge and a mixture of attitudes towards handling the machinery inside the information kiosks.

An examination of the visual instruction used to train site coordinators will show how current theories of visual learning and instructional design were applied in the selection of media and in the strategies for teaching. In addition, a significant effort was made to overcome expressed anxiety about handling the computer and peripheral equipment by incorporating humor and visual instructions of procedures to help the coordinators associate the equipment maintenance tasks with other routine tasks.

Discussion of the Problem

The site coordinator is usually the first person called upon to respond to unexpected problems with the interactive video system. The Site Manual serves as a "job aid" or reference material which provides text and visual instructions for performing simple maintenance tasks. All site coordinators have received hands-on training in these tasks, but since many of these procedures are done infrequently, the printed guidelines provide a concise checklist from which the coordinator can reconstruct the proper procedure to complete a given task.

The organization of the content material in this manual is based on the specific tasks identified and appropriate instruction for those responsible for performing these tasks. Responsibilities for routine

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maintenance and initial trouble shooting on the IDD systems have been assigned to many non-technical persons. As Andrew Trotter suggests, with reasonable care and simple preventive techniques microcomputersputers can function with minimal complications (Trotter, 1988). Good housekeeping, equipment security, and limited staff training are important preventive measures for minimizing equipment problems. This project which requires supervision from a distance faces particular challenges in developing effective channels for communication and feedback to promote and reward responsible performance by those overseeing equipment maintenance and operations (Romiszowski, 1981).

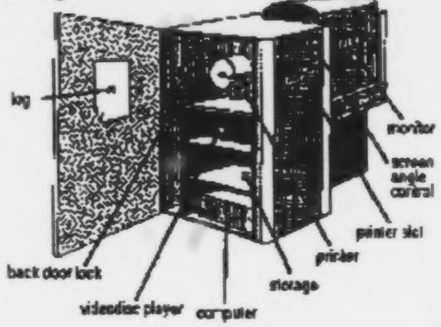
The illustrations within each lesson were designed to direct the site coordinator's attention to specific equipment parts or to the relationship between certain pieces of equipment. These illustrations are meant to provide what Richard Mayer and Joan Gallini refer to as an "explanative" function--helping the reader interpret the information presented in the text (Mayer & Gallini, 1990). According to Mayer and Gallini interpretive illustrations help the reader develop a mental schema of what is visually represented. Their research indicates that this type of illustration will improve recall and problem solving application of the explanative information for those with little prior knowledge of the subject matter. The site manual is designed to provide explanatory support for those individuals with limited computer experience. We, therefore, decided to use explanatory illustrations to help the site coordinators more readily interpret the tasks described in this manual.

The work of Dwyer, Dwyer, and Canelos (Dwyer, Dwyer, & Canelos, 1989) analyzes and compares the effectiveness and efficiency of different styles of visualized instruction. Black and white detailed and shaded drawings appear to be the most suitable style for the illustrations of procedures discussed in this manual. In future revisions to this material could include more digital video images to capture examples of maintenance being conducted at different sites by different coordinators. The clarity of the digital image accessible when this manual was designed was limited. However, digital video illustrations would be useful to bring this manual closer to the user's contextual needs. The illustrations of cable connections shown on Figure 1 on the next page demonstrate the amount of information simple black and white drawings can provide.

The manual has three major chapters: (1)Getting Started; (2)Routine Main-

Figure 2

Opening the Kiosk



1. Getting Started

1.1. Opening the Kiosk
(reduced from manual)
1.2. Power Connections
1.3. Cable Connections
1.3.1. A detailed View
1.3.2. A Close-up View
1.4. System Log Sheet

Figure 1 A Close-up View of Cable Connections

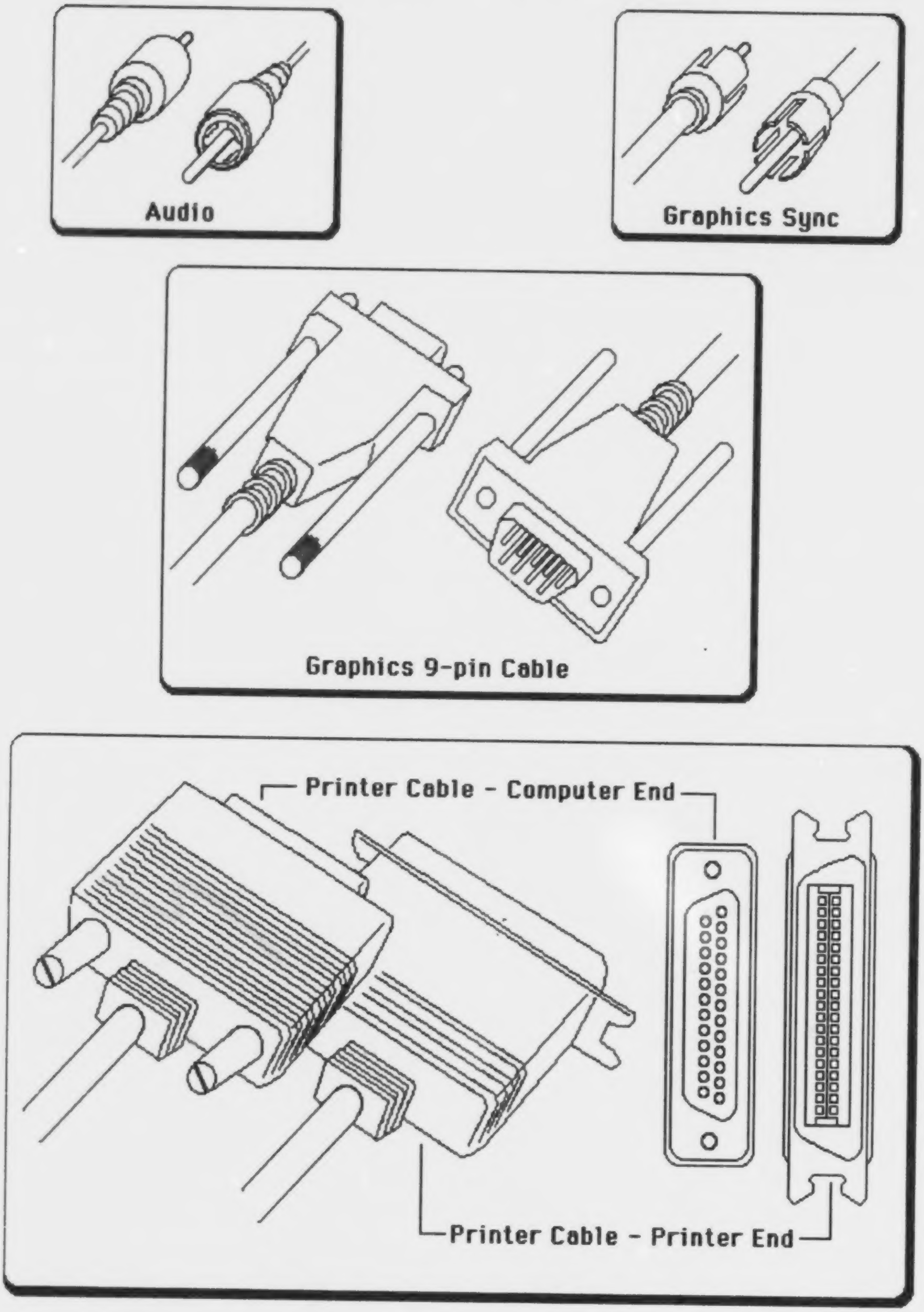
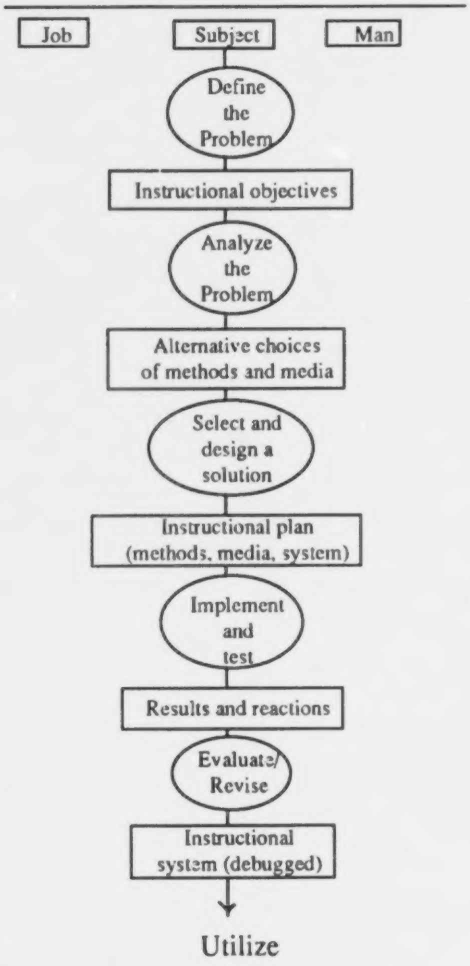

Audio
Graphics Sync
Graphics 9-pin Cable
Printer Cable - Computer End
Printer Cable - Printer End

Figure 3 Systems approach at the micro level - applied to Instructional Design.



Job
Subject
Man
Define the Problem
Instructional objectives
Analyze the Problem
Alternative choices of methods and media
Select and design a solution
Instructional plan (methods, media, system)
Implement and test
Results and reactions
Evaluate/ Revise
Instructional system (debugged)
Utilize

from Romiszowski, A. J. (1981). *Designing Instructional Systems*. New York: Nichols Publishing Company.

tenance; and (3)Getting Help. Several other chapters are included which provide additional, optional information for site coordinators: (4)Program Updates; (5)A User's Guide to the Information; (6)Learning About the Technology; (7)About the Development Team; and (8) Marketing the System in Your Area. The information presented in the first three chapters is most critical to the site coordinators key responsibilities.

Methodology

The process for organizing the development of this manual is summarized in the list of production activities presented in Figure 3. Our procedure was guided by the systems approach to instructional design proposed in the outline of the design process shown in Figure 3. Romiszowski (1981) also suggests an analysis process for selecting appropriate instructional method for a given task and performance context which was used in the development of this manual.

Our analysis of the problem and development of instructional materials proceeded as follows:

(1) Identify the anticipated maintenance tasks and gradually develop a list of "unexpected problems" based on calls from pilot systems and in-house incidents of system failures.

(2) Describe how to fulfill these tasks by breaking out each action into a complete and unambiguous step-by-step procedure.

(3) Test each procedure on equipment in the office. Ask co-workers to take the list of procedures and see if they can perform the task.

(4) Apply the principles of the Program of Systematic Evaluation of visuals developed by Francis Dwyer (Dwyer et. al., 1989) to provide black and white drawings to illustrate the equipment involved in maintenance tasks and system problem assessment.

(5) Distribute preliminary version of manual as systems are individually installed at specific site locations. Use manual in one-on-one training sessions and document site coordinator's response to material and note specific questions not included in material.

(6) Incorporate and interpret suggestions from individual site coordinators in revision of document.

(7)Distribute revised site manual at group workshop for site coordinators. Include the revised document in hands-on training and discussion session to note and document additional comments regarding revised site manual presentation of procedures.
(8)Revise pieces of document and distribute. Follow up with telephone contact with site coordinators.

Design and Development Process

The design and development process required repeated evaluation and assessment of the explanation of procedures. This was the only way we could validate the presentation design. Since each of the three chapters examined in this report represents three distinct kinds of tasks--set up, maintenance, problem assessment, we will examine the design process by taking a closer look at the material within each section.

Another aspect to the design process which will be mentioned briefly in the context of each section related to our attempt to address some site coordinators' feelings of anxiety and resistance to the additional work of caring for these systems. Interviews with site coordinators in the field, revealed that some individuals were very anxious about their ability to handle the equipment responsibilities described in the manual. Others seemed to feel that the interactive video systems were great as long as nothing went wrong. Even having to change paper in the printer was too difficult for them to tackle on their own.

Problems like these are not resolved by merely providing a support manual. However, we made a significant effort to respond to site coordinators' attitudes towards the system by incorporating humor and informal supportive remarks throughout each section of the site manual. Our objective with these devices was to make the manual a more personable document and to make the site coordinator feel a stronger link with the IDD group.

1. Getting Started: An introduction to the new technology. The overall objective for this section was to provide a general orientation to what pieces of equipment are necessary to make the interactive video program work, how these pieces are connected, and where they are located in the kiosk cabinet. (See Figures 2 and 4.)

2. Routine Maintenance: Explaining responsibilities of site coordinators. The objective for this section was to provide a simple listing by equipment of routine maintenance tasks which the site coordinator would need to know how and when to do.

Figure 5
Examples of maintenance tasks.

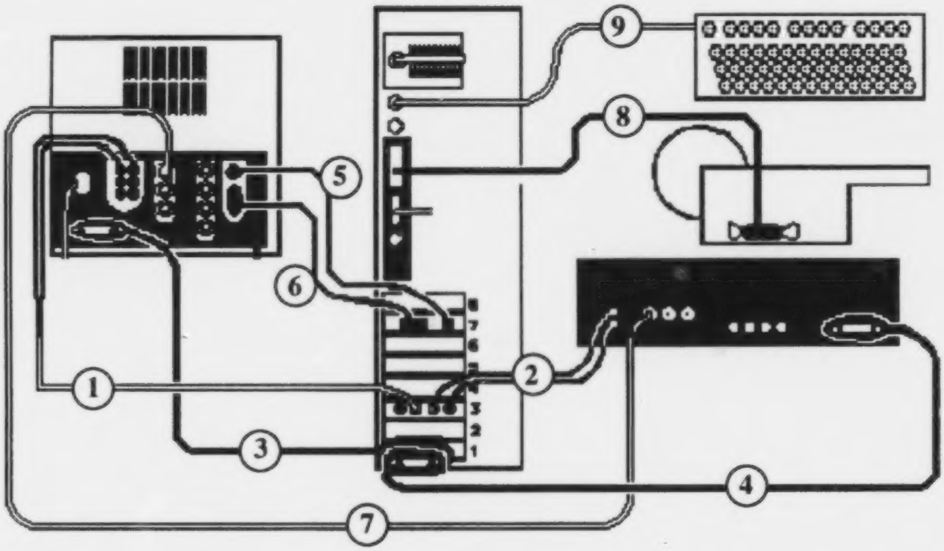
2. Routine Hardware Maintenance
- **2.1. Printer**
    - 2.1.1. Safety Note
    - 2.1.2. Changing Paper
    - 2.1.3. Changing Ribbon
    - 2.1.4. Usage Statistics
- **2.2. Routine Cleaning**
    - 2.2.1. Kiosk
    - 2.2.2. Touch-Screen
    - 2.2.3. Videodisc
    - 2.2.4. Printhead Cable
- **2.3. Obtaining Supplies**

Figure 4 Check the Cable Connections.

The **computer processor** controls all the other pieces of equipment through communication signals which pass through the cable connections. Each of these pieces of equipment is connected to the computer--Monitor, Videodisc Player, Printer, and Keyboard.

When one of the cable connections is loose, a function--such as audio, images on screen, or printing--may be lost. The following guidelines will help you identify the cables by their function. Use this diagram and the closer view of cables on the following pages to check the connections.

Be sure to turn the power off before you check the connectors.



If no audio or audio in only some places:

Check the **audio** cables:
① Computer to Monitor (channels 1 and 2)

② Computer to Player (channels 1 and 2).

If no image or only part of image on screen:

Check **IEEE488** cables:
③ Computer to Monitor

④ Computer to Player

Check **Graphics Sync** cable:
⑤ Computer to Monitor

Check **Graphics 9-pin** cable:
⑥ Computer to Monitor

Check **video** cable:
⑦ Monitor to Videodisc Player

If no print outs:

Check **printer** cable:
⑧ Computer to Printer.

If "301" is the only information on the screen when you power-up the system:

Check **keyboard** cable
⑨ Computer to Keyboard

Figure 6 Something's wrong!

Check this first!

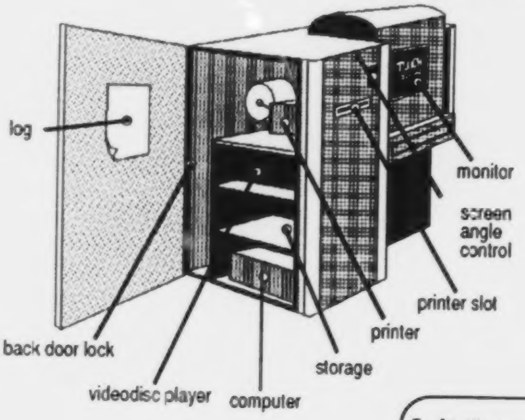
Is it the power source?
✓Are all connections snug?
Check connections 1.2. & 1.3.

✓Is the system connected to its power source?
Make sure no plugs have been knocked out.

Is it the image on the screen?
✓Only part of the image appears on screen (i.e., text appears but no video pictures) or screen is black, audio continues.
Check connections 1.2. & 1.3.

✓The wrong picture appears.
Clean video disc 2.2.3.
If problem remains, restart system 3.2.3.

✓Screen does not respond to touches.
Restart system 3.3.



Is it the audio?
✓No audio while motion video is playing.

✓No audio when screen image is not changing.

✓No audio at all.
Check cable and power connections 1.2. & 1.3.
If problems remain, restart the system 3.3.

Is it the computer?
✓Nothing is working.

✓Image on screen is frozen.

✓Screen does not respond to touch.

✓Error message appears on screen.
(Please write down number to share this information with us.)

✓Images on screen are distorted.

✓Screen doesn't show program selected.

For all of the above:
First check all power & cable connections.
If problem remains restart the system 3.3.

Is it the printer?
✓Printer doesn't work.
Check power & cable connections 1.2. & 1.3.

✓Print is too light.
Change ribbon 2.1.3.

✓Printer is out of paper
Change paper 2.1.2.

✓Printer is jammed.
Follow steps in 3.2.1. & 3.2.2.

Ouch! The printer is the source of most problems.

3. Getting Help: Responding to problems with system. This section addresses two primary objectives. First, we wanted to convey the message that site coordinators are encouraged to call IDD for help if they are unsure of what to do or if they need confirmation that their assessment of the situation is correct. Second, we wanted to provide a simple but clear representation of a checklist that coordinators should follow to generally assess what type of the equipment problem had occurred. See Figure 6.)

Summary and Conclusions

The site manual appears to fulfill its function as a job aid for site coordinators. But this manual cannot succeed on its own. Several factors are critical in determining whether a site coordinator will be able to use this manual. All site coordinators must receive preliminary hands-on training in all the tasks described in the manual. The description provided in the manual should be referred to throughout the hands-on training. Comments and suggestions by site coordinators should be encouraged and documented during the training sessions. This type of feedback from site coordinators is part of the formative evaluation of the manual, and it is important to document these comments to prove and improve the value of the manual as a job aid material (Romiszowski, 1981).

We also learned through subsequent visits at sites that the site coordinator should have several associates who are also trained and are encouraged to provide alternate support in attending to the interactive video system. At the time of installation those attending the hands-on training should sign a list that makes all attendees share responsibility for equipment care. The site coordinator would be charged with leading this coordinated effort. The team approach to maintenance and problem assessment would improve the quality of equipment care and would encourage a greater sense of ownership among a greater number of personnel. In addition, we have found that it is logistically difficult to have one person be the sole responder to equipment needs. Generally people are away from their place of work for work-related travel, vacation, or illness several times a year. Thus, a backup is essential, but a team approach is more desirable.

As the Site Manual is put to use by field coordinators we will continue the evaluation process of the instructional value of the manual to determine how it is helpful and in what areas it is not helpful. We are particularly interested in learning in what ways the visuals provided in the manual were helpful. How often did the site coordinators use the manual and for which procedures? Were there any procedures for which the manual was never used? Were there other ideas for illustrations which site coordinators would have included in the manual? By documenting the type of phone calls IDD receives from site coordinators we can also determine whether coordinators are referring to the manual before they call or whether they call for help first. We will also want to build a list of questions from site personnel which are not covered in the manual.

Finally, having worked on this manual intermittently for over two years we have come to regard it as a working document which must be accessible to additions and revisions at any time as needed. To serve the site coordinators out in the field it is important that this document grow to become more of a reflection of the site coordinators tips and suggestions for routine maintenance and less of a training document presented to the site coordinators.

Acknowledgement

The original black and white drawings of cables, cable connections, and equipment kiosks were created by Leslye Bloom. Without her artistic contributions this project would not have been nearly as successful.

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Virtual Reality and Visual Design

Hilary McLellan

Introduction

Virtual reality is a newly emerging tool for scientific visualization that makes possible multisensory modeling of scientific data. With virtual reality, the emphasis is still on visualization, with three-dimensional graphics, but the other senses are added to enhance what the scientist can "visualize." This includes haptic visualization, involving the sense of touch, and three- dimensional audio. Virtual smells are also envisioned.

The design of virtual reality systems to optimize their potential as a tool for scientists is a challenging goal for multimedia designers. This paper will examine four topics: (1) What is scientific visualization? (2) What is virtual reality? (3) What are the design issues relating to virtual reality? (4) How can virtual reality be effectively applied as a tool for learning?

Part I: What is scientific visualization?

According to Lewis (1989), visualization is "the animated display of symbolic information in the form of concrete objects and physical relations." With computers, it is possible to build sophisticated models of complex natural phenomena and explore these models for new insights concerning the phenomena in all their complexity. Scientists often have a much easier time getting an intuition from pictures than they do from numbers and tables of formulas. With computers, numbers can be converted into images that appear as two- or three-dimensional color pictures or movies on computer screens. Virtual reality takes this visualization one step farther: instead of just looking from the outside, you can go *inside* the picture on your computer screen.

Rheingold (1991) differentiates between a 'visual display,' on which information is displayed, and a 'visual instrument,' a display designed specifically to enhance human judgment in a specific task. Virtual reality is a type of visual instrument designed to enhance human judgment and insight concerning three-dimensional phenomena. Graphic design expert Edward Tufte (1989): explains the importance of this: "Even though we navigate daily through a perceptual world of three spatial dimensions and reason occasionally about higher dimensional arenas with mathematical ease, the world portrayed on our information displays is caught up in the two dimensionality of the endless flatlands of paper and video screen. All communication between the readers of an image and the makers of an image must now take place on a two-dimensional surface. Escaping this flatland is the esssential task of envisioning information ---

for all the interesting worlds (physical, biological, imaginary, human) that we seek to understand are inevitably and happily multivariate in nature. Not flatlands." Virtual reality makes it possible to escape flatland. Ultimately, virtual reality (VR) provides the basis for an unprecedented representation-rich approach to examining and solving problems.

Part II: What is virtual reality?

There are two kinds of virtual reality. One type of virtual reality is an attempt to make a realistic representation of a world around us. Here the goal is to simulate a real surrounding. In the second type of virtual reality, the real reality is too complex to deal with, so the goal is to create a simplified reality that facilitates insight and decision-making.

Virtual Reality is based on a convergence of several new technologies, including: (1) lightweight 3-D stereoscopic displays; (2) magnetic positioning systems; (3) advanced graphics chips; (4) continuing expansion of computer memory; and (5) novel interfaces between human and computer, including interfaces that the user actually *wears*, like clothing

The most widely used virtual reality technologies are the Data Glove, filled with fiber optic cables, and the Head-Mounted Display, 3-D goggles with two tiny screens showing stereoscopic liquid crystal displays of the image you would normally view on the computer screen itself. Other interface devices, which are used in conjunction with the Head-Mounted Display, include: a Body Suit (filled with 50 sensors and 300 feet of fiber optic cable); a treadmill (to simulate walking in a virtual building); and a force feedback arm (to simulate the resistance of real objects in their virtual counterparts).

Virtual reality is an artificial environment created by communications and computing systems. With virtual reality, the computer senses the natural behavior of the user and displays an image from the perspective of the user. The software is designed to permit the construction and maintenance of vast digital databases; the data needed to present a virtual scene from all points of view— anywhere the user can look. A virtual reality system does more than make 3-D pictures: it gives the user the illusion of walking around in the 3-D scene. Virtual reality is "a 3D video game you can enter by strapping something onto your face that fools your senses into perceiving an environment that surrounds you on all sides. The thing strapped to your face is called a Head-Mounted Display." (Robinett, 1991)

The Head-Mounted Display contains a magnetic sensor whose precise position is tracked by a small box on a wall or ceiling nearby. Every time the person in the goggles moves her head, the tracker transmits this 'data' to the computer, which, in turn, changes the scene viewed in the goggles with only the slightest delay. When the user turns and looks to the left, or the right, the computer-generated scene shifts accordingly. This makes huge demands on computer memory and processing. The interfaces create the illusion that you're moving around inside an artificial space that's standing still outside of you.

The Data Glove transmits and receives data so that the computer generated image responds to the movements of the user's hand, encased in the glove, as well as responding to the user's head movements, tracked by the Head-Mounted Display. A three-dimensional model of this glove appears in the image shown in the goggles. This three-dimensional model of the glove moves in correspondance with the user's hand movements in the real glove. The model of the glove provides an indicator of the user's position within the virtual space to orient the user. There are three basic commands for directing the Data Glove: (1) Point a finger and you move in that direction; (2) Make a fist, and you can pick up whatever object the fist touches; and (3) Open the fist and the object will fall or fly away in any direction.

Virtual reality makes possible new ways of perceiving the real world: to see the invisible, to travel at the speed of light, to shrink yourself into microscopic worlds. According to Foley (1987), "The ultimate objective of artificial-reality is to develop a simulated environment that seems as 'real' as the reality it depicts. The profoundest strength of the interfaces, however, may lie in their ability to go beyond reality itself, by modeling in concrete form abstract entities such as mathematical equations, and by enabling users to surmount problems of scale in manipulating atoms and galaxies alike."

Part III: What are the design issues relating to virtual reality?

There are many important design issues that must be considered in relation to virtual reality. In order, to highlight some of the most important design issues, this discussion will start by focusing on three existing applications of virtual reality: (1) biochemistry; (2) radiology; and (3) architecture.

Biochemistry

In this virtual reality system, a three-dimensional graphic model of a molecule --- gigantically enlarged --- has been combined with haptic visualization (touch) in the form of a force feedback arm. This virtual reality system is used to help chemists explore the force-fields that bind molecules together or cause them to repel one another. In addition to three-dimensional graphics that help chemists see the microscopic molecules at an enlarged scale, a force feedback arm simulates feedback pressure based on the force-fields. This helps scientists sense where to dock individual molecules into a combination of molecules, based on mutual attractions and repulsions. If two molecules repulse each other, they won't combine well, but if they attract, one can be docked to the other to form links in a chain of molecules. This research can help biochemists searching for targets on protein where they can attach drugs. Macro-molecules possess complex three-dimensional structures. Understanding these structures is often the key to understanding chemical properties. The docking problem is important both to biochemists attempting to understand how proteins and nucleic acids work, and to chemists doing analytic drug design, attempting to find or synthesize drugs with specified active properties and without undesirable side effects. Brooks (1988) comments, "Walking around and through the large molecule may provide quicker understanding of its structure, and such problems as drug-enzyme docking may be approached with greater insight." If the active docking site is not in a convenient position, the user can change point of view and continue with the docking.

The researchers at the University of North Carolina have found that the haptic visualization --- force feedback --- is even more valuable to scientists for the molecule docking application that the 3-D visualization. The experiments so far indicate that the chemists can determine the nature of the best docking much more effectively with force feedback than with the best visual systems that can be built. According to one description, the force feedback arm "literally pushed back. It pulled and twisted, too --- sometimes quite hard. The motions simulated the magnitude of attraction, repulsion and torque that occurred as the sum of atomic interactions between the two molecules. (Stix, 1991)" Here, in this application of virtual reality to scientific visualization, the key issue is to identify the best way for scientists to interact with a three-dimensional 'virtual' model of molecules in order to promote insight and discovery. This has promise for enabling the chemists to determine new drugs for working in specific sites where they understand the shape and electrical forces around the site. Haptics (force field) can perhaps aid perception most when large variations in magnitudes occur in the fields. The eye quickly recognizes bigger and smaller in visual representations, and it is superb at detecting discontinuities. A haptic display makes magnitudes vivid (Brooks, Ouh-Young, Batter, & Jerome, 1990). Here, in this application of virtual reality to scientific visualization, the key issue is to identify the best combination of visual and haptic visualization tools for scientists to interact with a three-dimensional 'virtual' model of molecules in order to promote insight and discovery.

Radiology

Virtual reality has been applied to several medical imaging applications, including radiology (i.e., radiation treatment for cancer). The key design issue for medical imaging applications of virtual reality has been to extend medical visualization tools such as computer tomography (CT), single photon emission computed tomography (SPECT), positron emission tomography (PET), magnetic resonance imaging (MRI), and ultrasound so that these tools are more useful and more flexible. All of these devices for noninvasively imaging the interior of the human body have the potential for producing three-dimension arrays of intensity values, but this potential cannot be fully utilized. Virtual reality can help to overcome this limitation. For example, a virtual reality application has been developed that helps physicians position the beams of radiation used in cancer therapy. By connecting the medical visualization data concerning where the tumor is located in a patient's body with a virtual reality visualization system, physicians can conveniently practice setting up two intersecting radiation beams so that they target the tumor, minimizing the radiation impact to surrounding healthy tissue.

Architecture

Virtual reality has been applied to architectural design. The architectural application of virtual reality provides a virtual environment with which the users are familiar --- they already know how to interact with a building, virtual or real. Everybody knows how to physically walk through and visually explore a building to understand its spatial interrelationships, and everyone is aware that climbing a flight of stairs to reach a balcony will provide a different vantage point from which to see the building. The Architectural Walkthrough provides several modes of interaction with the virtual building that mimic how people interact with a real building. In the Walkthrough, interface devices include the head-mounted display and a treadmill. The head-mounted display enables architects and clients to better appreciate and assess three-dimensional designs. The treadmill provides additional kinesthetic input into the understanding of building size and scale. Left-right turning is controlled with some bicycle handlebars attached to the treadmill (Brooks, 1988).

The key design issue for the architectural application of virtual reality as a visualization tool has been to accomodate two types of users: architects and their clients. Whereas the architect has been trained to visualize unrealized designs, the client may often be unable to translate drawings and descriptions into a complete mental image.
With this limitation, the client may wind up accepting unsatisfactory designs because of some misunderstanding. The Architectural Walk- through has been developed to avoid such problems of visual communication and visual understanding. With this virtual reality visualization tool, the designer is able to rapidly prepare a design solution, and receive meaningful feedback from the client that makes it possible to adjust and refine the design to the client's satisfaction. There should be no surprises when the building is finished. The Walkthrough project is aimed at the development of a visualization tool with which a designer and his or her client can explore a building that is as yet unbuilt (Brooks, 1988).

Researchers have found that frequent users such as architects may want complete freedom of motion (joysticks), while an infrequent user, for example, a client, may desire a restrictive but more natural interface (a treadmill with a head-mounted display or big screen display) (Brooks, 1988). This is a very important point for designers to note: different users may have different needs.

Overview of Design Issues

These three applications of virtual reality provide some insights concerning the issues that designers face in developing scientific visualization applications for virtual reality. What do the designers themselves say about VR design issues? Myron Krueger (1991), suggests that there are nine essential considerations for the design of virtual reality systems. These include: (1) Visual Expectations; (2) Optical Flow; (3) Perspective; (4) Connection to the graphic world; (5) Self-Image of the user imaged in the virtual reality system; (6) Lost in space --- Navigation; (7) Motion sickness; (8) Resolution; and (9) Environmental Displays.

Frederick Brooks (1988) emphasizes that designers should not take 3-D perception for granted in designing VR systems. Brooks points out that virtual reality draws upon many faculties adapted for perceiving depth: stereopsis, head motion paralax, and the kinetic depth effect. This is the advantage of VR over other visualization methods. However, 3-D understanding is difficult without practice in a particular model. "People have rather precise world-models of their bedrooms or offices. We can navigate in the dark and reach for objects without looking at them. Forming similarly accurate mental models of virtual worlds requires hours of exposure to these worlds, plus every feasible cue."

These cues include depth cues, such as the kinetic depth effect, force cues, perspective, space exclusion (the notion that two objects cannot occupy the same space at one time), and stereopsis. Perspective is an effective depth cue when parallel lines and right angles are numerous in the model. On the other hand, perspective can be counterproductive when the discovery of parallel elements amidst disorder is part of the user task, as it is with molecular structures. Stereopsis --- stereoscopic vision --- is not a powerful when strong perspective cues are already present. However, stereopsis can be a powerful depth cue when perspective cues are not very helpful, as is the case with the molecular docking application. The kinesthetic depth effect is a very powerful depth cue. And the ability to move objects, not just viewpoints, in the virtual world appears to enhance the user's perception of the VR visualization world. Space-exclusion plays a large role in our perception of "realness."

Brooks (1988) recommends that user-positioned light sources and a user-controlled camera zoom can be a valuable addition to a VR visualization system. These tools substatially enhance the user's perception of structure in the exploration of a passive virtual scene.

Another design issue that Brooks (1988) highlights is navigation. Research suggests that the user often needs to see both a view of the virtual world and a map showing where he is and where he is looking. Viewers start out using map navigation and then progress to scene navigation as they build a precise mental world-model. Brooks points out that this corresponds to real-world behavior. The two kinds of navigation, map and scene, require different metaphors, and different interface devices may be appropriate.

This points up another essential VR design consideration: metaphors. Brooks (1988) reports that in designing interfaces, researchers have found that the explicit selection of a metaphor for each interface substantially helps in defining the design issues and making consistent decisions. Different metaphors demand, or are permitted by, different types of display devices and interface devices. For example, in the architectural walkthrough application, screen projection constrains the designers "to metaphors with look-ahead and no real-world motion, such as a helicopter metaphor, or a steerable shopping cart. A head-mounted display would permit look-aside and a tethered real-world motion, rather like walking about on a separately navigated flat-bed truck. Metaphor determines whether position or velocity-specifying devices are appropriate." (Brooks, 1988)

Brooks (1988) sums up the issues involved in designing VR visualization applications as follows: "The view is best which provokes the most profound insight; who is to say in advance which it will be? It may well be neither the most detailed nor the most highly resolved. The more visualizations one sees, the better the chance of finding a fruitful one." Brooks further explains that, "The best visualization strategy for abstractions is therefore quite different than for real objects. Rather than working on making one visualization ever closer to the ideal, the view-maker should devote his energies to the production of many different visualizations, as many as imagination will conceive and energy will permit. Our goal, then, must be to give scientists tools to easily generate many insight-producing visualizations from the same data set." These comments reflect the fact that the design of virtual reality visualization applications is at a very early stage of development, based on recent technological innovations, although Brooks has been researching this kind of visualization tool since the late 1960s.

Edward Tufte, a graphic design expert, has some insights on visual design that are relevant to virtual reality, Tufte has written two books on visual design and is working on a third. The third book, in development, is about effective design for the pictorial representation of verbs, motion. One way he is exploring the topic is through the art of magic. Magic tricks have changed little over the last three centuries, he says, so he can trace how the same tricks have been described over a long period. Magic has three dimensions in time (time is the fourth dimension). But in addition, magic has an extra fith dimension that Tufte finds intriguing: "There is the revealed and the concealed --- there's what the audience sees, and there's the mechanism of how to do the trick." (Evangelauf, 1991) Perhaps the visual designers of VR systems can learn from this: What should the participant see? What should be kept out of sight?

Related to this is a concept from David Jay Bolter, who writes about the format and structure of hypertext-based writing. Bolter's (1991) proposes the concept of a filter. "A filter is the logical analog of an optical filter. Placed between a model and an observer (the user), it can mask out detail, add emphasis, combine information from several sources, and help determine presentation style." How, in what way, can this filter be determined? And how can this concept be applied in virtual reality? These are issues that designers may want to consider.

William Bricken, a virtual reality designer at the University of Washington's Human Interface Technology Lab has proposed that virtual reality represents a new paradigm in the design of human-computer interfaces. This new paradigm is based on the transition from multiple points of view external to the human, to multiple points of view that the human enters, like moving from one room to another. According to Bricken (1990), the changes that define the paradigm shift accompanying VR technology are as follows:

OLD PARADIGM	NEW PARADIGM
symbol processing	reality generation
viewing a monitor	wearing a computer
symbolic	experiential
observer	participant
interface	inclusion
physical	programmable
visual	multimodal
metaphor	virtuality

What are the technical issues involved in the design of virtual reality simulations? Brooks (1991) has explained that computer memory limitations and limitations in real-time animation or movement are the key technical design issues related to virtual reality: "If I look at the different components of trying to make a virtual world look real when you look at it, the part we know best how to do is how to make it high image quality visual realism with good lighting. The so-called "rendering problem" is solved in principle. That is, for any given frame, given enough computer time, we can make it look very good. The problem of how to make the world move in real time is the hardest of the problems and how to make it move in real time in response to one's interaction, as opposed to some preplanned scenario, is very demanding on computational speed." Brooks recommends a design strategy of progressive refinement: "Real-time motion, complex world-models, and high-quality images create a workload that overwhelms today's hardware. A dynamic technique, rather than a static compromise, best resolves this dilemma."

Part IV: How can virtual reality be effectively applied as a tool for learning?

Virtual reality may be especially valuable for supporting the design of learning systems that adhere to the situated learning model put forward by John Seely Brown and his colleagues at Xerox PARC (McLellan, 1991b). The situated learning model highlights a set of six useful strategies for successful learning: (1) Apprenticeship; (2) Collaboration; (3) Reflection; (4) Coaching; (5) Multiple practice; and (6) Articulation. All of these strategies can be embedded in a virtual reality-based training system. Indeed, virtual reality appears to be ideally suited for facilitating situated learning for jobs in complex technical environments.

According to Brown (1989; Brown, Collins, & Duguid, 1989), knowledge is situated; it is a product of the activity, context, and culture in which it is developed and used. Activity and situations are integral to cognition and learning. Therefore, this knowledge must be learned in context --- in the actual work setting or a highly realistic or "virtual" surrogate of the actual work environment.

How can virtual reality support situated learning? Virtual reality provides a high degree of sensory realism, in several ways: the three-dimensional visual display that the user actually seems to enter into via a headmounted display, pressure feedback linked to the electronic sensors built into the glove mechanism that inputs data based on the position and movement of the learner's hand, and the simulation of actual textures and feedback pressures --- all created electronically (Rheingold, 1990).

Virtual reality provides users with the opportunity to practice activities involving fine motor skills using the hands, such as surgery or molecular chemistry, while obtaining highly precise and sophisticated feedback on performance from the computer system that underlies the virtual environment. This kind of virtual reality learning system makes possible repeated practice of skills that are difficult to practice in the real world or through any other training method (McLellan, 1991).

Virtual reality provides the benefit of articulation in many forms: certain skills or aspects of the learning task can be isolated out for practice in a way that is not possible otherwise. Foley (1987) provides some insights concerning this: "The ultimate objective of artificial-reality is to develop a simulated environment that seems as 'real' as the reality it depicts. The profoundest strength of the interfaces, however, may lie in their ability to go beyond reality itself, by modeling in concrete form abstract entities such as mathematical equations, and by enabling users to surmount problems of scale in manipulating atoms and galaxies alike." This articulation of certain features of the environment by changes of scale can be observed in some virtual reality applications, for example the molecule docking application discussed above. In this application, the change in scale, together with the different resistances calibrated for each type of molecule encountered by the pressure feedback arm, articulates and highlights the force fields and the attraction and repulsion between molecules.

Another way that these interfaces may go beyond reality is in terms of the performance monitoring feedback they can offer. For example, researchers envision that virtual reality can someday be used to teach a surgeon how to handle a scalpel without drawing blood by monitoring the fine motor skills involved in carrying out this sensitive procedure. In this application, an attending physician would be able to sense and correct the movement of a student's scalpel during surgical practice on a cadaver (Stix, 1991). This virtual reality training system would provide ongoing feedback concerning the accuracy of the learner's movements by means of a tactile glove that applies pressure on the palm of the hand. Virtual environments provide unparalleled opportunities for multiple practice. Here, designers need to ask: how can the feedback be used to report on performance? Deciding what factors are important to monitor is a promising area for research.

According to the situated learning model, in order to make the training memorable, it must be embedded in a story, a scenario. Brown (1989) emphasizes the importance of stories for effective learning. According to Brown, narratives play a vital role in the transfer and integration of information and discoveries. And stories help people keep track of their discoveries. As stories are shared, fragments of other stories are melded together with them that enhance the meaning of the original stories, as well as transferring information about the discoveries to others in the workplace. According to Brown, troubleshooting is basically storymaking. Swapping stories essentially means bootstrapping on each other's experience. By exchanging stories, we "bootstrap" on a community of experience, our own experience and that of coworkers. Sophisticated simulations, designed to teach people how to make sense out of complex, unclear data to solve problems, are a form of storytelling, or perhaps scenario building. Brown (1989) explains that stories are anchored in episodes. Workers can refer back to stories or scenarios in their training in attempting to make effective decisions in real-life work situations.

This is similar to a model put forward by Brenda Laurel whose background is in the theater. Laurel (1989) articulates a metaphor of computer-as-theater. She comments, "millennia of dramatic theory and practice have been devoted to an end that is remarkably similar to that of human-computer interaction design; namely, creating artificial realities inwhich the potential for action is cognitively, emotionally and aesthetically enhanced." This is also remarkably similar to what training and learning are about.

According to Laurel,

> It is not enough to imitate life. Drama presents a methodology for designing worlds that are predisposed to enable significant and arresting kinds of actions --- where characters make choices with

> clear causal connections to outcomes, where larger forces like ethics, fate or serendipity form constellations of meaning that are only rarely afforded by the real world. Dramatically constructed worlds are controlled experiments, where the irrelevant is pruned away and the bare bones of human choice and situation are revealed through significant action. The predispositions of such worlds are embodied in the traits of their characters and the array of situations and forces embedded in their contexts. If we can make such worlds interactive, where a user's choices and actions can flow through the dramatic lens, then we will enable an exercise of the imagination, intellect and spirit that is of an entirely new order."

This vision of dramatically constructed worlds appears to offer great potential as a source of inspiration for designing virtual environments in accordance with the situated learning model. The concept of drama as a social phenomenon, performed before an audience is a vital consideration. With situated learning in virtual environments, the audience is the instructor, who provides coaching and criticism of the performance until the learner "gets it right." This kind of training is like the "Mystery Dinners" and "Mystery Weekends" that have become popular in recent years, where everyone participates and the identity of actors performing roles is not revealed until afterwards. We can think of the virtual training environment as an extension of the metaphor of computer-as-theater.

Conclusion

This paper provides only an introduction to the design issues involved in designing virtual reality visualization systems. For a more extended discussion of virtual reality applications in education, McLellan (1991a) provides a survey of virtual reality applications in education. McLellan (1991b) analyzes several virtual environment training applications that conform to the situated learning model.

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THE ARTS

Contemporary Art: Today's Window on Tomorrow's Communication Media

Patricia Search

New technology is redefining the syntax of visual communication and rapidly changing the way we disseminate information. Interactive hypermedia computing is directing us away from narrative communication and introducing challenging, new multisensory experiences that require unique cognitive and perceptual skills. Information designers have traditionally looked to film and television for insights into how to integrate images, words, and sound. However, now we must look for new guidelines for structuring and presenting information in a hypermedia environment where the meaning of images and text is determined by user-defined links between audio-visual data. This paper takes a look at these issues and shows how some contemporary art forms may serve as a resource for information designers by providing new insights into how to structure words, images, and sound in a multidimensional information system.

Introduction

Hypermedia computer programs allow users to randomly access database information that is stored as text, still images, motion video, animation, and audio recordings. Hypermedia is a dynamic and exciting method of communicating information because users can pursue personal interests at individual levels of expertise. For these reasons, business, industry, and schools are rapidly adopting this medium for sales, training, and education.

But hypermedia computing poses new challenges for the designers and users of these systems. In more traditional, narrative forms of communication, there is usually one level of authorship and one design format that highlights information hierarchies and provides structure and continuity for the document. However, in a hypermedia program, there is no predefined information hierarchy because the user creates the links to the data and structures the information. Instead of one level of authorship, there are multiple levels of authorship. For example, there are the authors of the individual source documents in the database, the editors and designers of the hypermedia program, and the users of the program who organize the information to meet individual objectives. These different levels of authorship bring diverse audio-visual formats to the hypermedia program instead of one unifying design structure. The result is an intricate network of sensory and cognitive associations that users often find confusing and disorienting.

Nevertheless, it is this multidimensional layering of perceptual stimuli that makes hypermedia a unique and potentially powerful communication medium. But we need design guidelines that eliminate confusion and form the foundation for new communication models in hypermedia computing. To meet this challenge it is important to understand the syntax of hypermedia. In particular, we need to understand how the characteristics of this medium, such as interactivity, multiple levels of authorship, and random access to multimedia data, impact the perception and interpretation of audio-visual information.

The Syntax of Hypermedia Communication

Hypermedia programs encourage the user to browse through a multimedia database and create links between varied sources of information. The focus is on the non-linear association of ideas rather than narrative communication. In this type of communication environment, the user can create an information structure that is an integration of diverse interpretive elements. Text, still images, motion video, and sound create an audio-visual network of perceptual and syntactical relationships that change dynamically as the user modifies the presentation of the information.

Nelson Goodman (1976) described the visual image as a syntactically and semantically "dense language" where the meaning of every mark is determined by its relationship to other elements in the image. Interactive computer programs give new meaning to Goodman's description by making it possible to create an infinite array of syntactical relationships. Users can explore the interaction of words and images by overlaying text and sound on top of still and moving visuals. They can alter the perception of time and space by integrating details from different images and audio tracks. In hypermedia, the perceptual relationships between audio-visual stimuli are intensified because of the lack of other types of sensory input. As a result, the designers and users of hypermedia programs must be particularly sensitive to the cross-sensory interaction that takes place in this type of communication environment. Researchers believe that there are perceptual links between colors, forms, and sounds that produce a "unity of the senses" (Marks, Hammeal, and Bornstein, 1987). For example, bright colors are associated with high-pitched sounds while dull colors are related to low-pitched tones. These relationships define multiple levels of sensory interaction and add another dimension to the semantic network of hypermedia communication (see Figure 1).

In hypermedia programs, it is also possible to alter conditioned responses to time and space. Time and space are no longer restricted to one-dimensional perspectives defined by the sequential flow of audio-visual information. Instead, multiple levels of time and space can be created by layering sound and images that depict different perceptual and cognitive relationships.

In addition, time can be compressed by condensing events into a sequence of still images or a few seconds of video. Or, by using analytical functions in computer programs to highlight various levels of detail, time and space can appear to expand into infinity. In turn, the perception of space is no longer restricted to the Western Renaissance concept of a physical environment defined by linear perspective. In hypermedia, space can be defined temporally as well as visually. Through the interaction of color, motion,

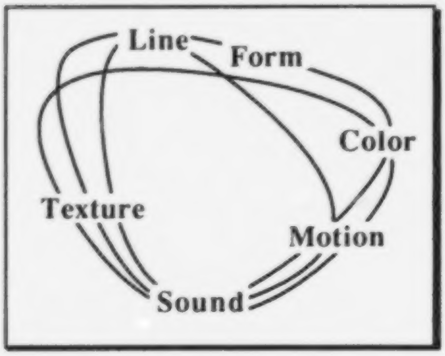

Figure 1. The juxtaposition of multisensory information in a hypermedia program results in dynamic syntactical relationships and cross-sensory associations.

and sound, space can become an inner dimension for the user as well as a sensory-defined, external experience.

Finally, a discussion of the syntax of hypermedia communication must also include a critical assessment of the psychodynamics of the medium itself. Users must be aware of the the difference between technologically processed information and reality. Hypermedia programs, with their high-tech equipment, comprehensive databases, and photorealistic images tend to project a false sense of authority and truth. Photographs and motion video, in particular, convey an unrealistic aura of credibility because of the extensive use of images in the news media, especially television. But camera angle and perspective in photographs and video often eliminate critical information and present a restrictive and subjective interpretation of an event. The pictures merely prove that an object or person existed in a particular time and space; they do not show the complete context of a particular activity. The designers and users of hypermedia programs must remember that a multimedia database is a limited body of information that reflects the attitudes and biases of many individuals, ranging from photographers and reporters to producers and public relations consultants.

New Communication Models

The developers of hypermedia programs must abandon communication models based on narrative communication and define a non-linear information structure that supports a multidimensional approach to design and perception. To meet this challenge, it is necessary to recognize the limitations that traditional formats and media-generated information place on perception and communication. It is also important to understand how a non-linear information environment can alter the perception of audio-visual stimuli and in turn, impact the interpretation of time and space.

Over the past few decades, many contemporary artists have addressed these issues in art work that continues to challenge and redefine the parameters of established communication structures. By examining some of these works, we can approach the study of hypermedia communication from new perspectives and ultimately, identify the unique characteristics in the semantic network of hypermedia that make this medium a revolutionary concept in information design.

This paper will highlight works in three artistic genres: **artists' books**, **performance art**, and **video art**. Like hypermedia programs, these art forms are characterized by (a) dynamic syntactical relationships and cross-sensory interaction; (b) multiple levels of design and cognition that force the user or audience (rather than the artist or author) to define the information structure; and (c) multiple planes of time-space interaction that create an array of cognitive associations, as well as a rhythmic movement in and out of various types of visual and psychological space (see Figure 2).

Artists' Books

Artists' books are works of fine art that gained momentum as a form of artistic expression in the 1960s. Also termed "bookworks," these works of art use non-traditional book formats to challenge the reader to reexamine the perceptual relationships between words, images, space, and time.

Bookworks like Michael Harvey's *White Papers* (1971) and George Brecht's *Water Yam* (1972) focus on the relationship between the physical format of a medium and the conceptual structure of the information. These two works abandon narrative communication and the traditional structure of the bound book and present the reader with boxes of loose, unnumbered cards. The non-linear

	Hypermedia	**Contemporary Art**
Dynamic Syntax Cross-sensory Interaction	☑	☑
Multiple Levels of Design and Cognition	☑	☑
Time-Space Interaction	☑	☑

Figure 2. Hypermedia computer programs and many forms of contemporary art share similar perceptual and cognitive characteristics.

format of these artists' books encourages the reader to reshuffle the cards to create new associations and relationships, thus blurring the boundaries between author, reader, and medium. In this interactive process, the reader becomes acutely aware of the perceptual relationships between the printed words and the physical characteristics (size, shape, layout) of the background or page. In the absence of any physical, thematic, or temporal hierarchy, these perceptual relationships form the structural domain that enables the user to organize and interpret the information.

Dieter Roth is another artist who uses bookworks to highlight the perceptual and cognitive limitations of the linear book format. In an untitled catalog that he created for an exhibition at the Stedelijk Museum in Amsterdam (1975), Roth uses childlike, black and white drawings to create a continuous design that sprawls from the beginning to the end of the book, eliminating the distinction between cover and pages as well as any reference to top-bottom orientation. These drawings continue onto the inside of "pockets" that have been formed by folding and stapling the pages. The reader is forced to abandon the original orientation of the book and turn the work upside down to see inside the pockets. In addition, page numbers, conspicuously absent in the beginning of the book where the reader is most likely to be searching for some conceptual structure and direction, suddenly appear, upside down, half way through the book. The entire design of the work forces the reader to reevaluate the limitations that linear forms of communication place on the perception and interpretation of information.

Many artists have also created bookworks that explore relationships between words and images. In his book *Investing: Public Relations* (1982), Mike Metz uses sequences of unrelated words to create the outlines of full-page graphics. His work shows how words and images, when integrated into one visual symbol, often surrender their semantic identities and assume new connotations based on relational meanings. In one example, Metz uses phrases like "an explosion," "a falling tree," "under a beach umbrella," "ONE WAY," and "the bunker was straight ahead" to form the physical outline of an arrow that is leaning 45 degrees off the vertical axis. The integration of these words into the shape of the arrow prompts the reader to form associations between the sequences of text and the symbol itself--associations that weave the individual components of this visual statement into a conceptual whole.

Similarly, Telfer Stokes and Helen Douglas use the juxtaposition of words and images to comment on the interrelationships between communication media, perception, and reality. In *Chinese Whispers* (1976) they use a series of photographs to reveal the limitations that words and images place on the perception of reality. In one photograph, the words "the edge of the wedge of the shape" are pictured along the edge of a wooden shelf which appears to be part of a kitchen counter. Additional photographs, however, reveal that the counter is really a prefabricated set that has been specially constructed to serve as a backdrop for the photo shoot. At this point, it is clear that the words and images are deceptively limiting in their description of the "real" environment. Stokes and Douglas continue their commentary on images and reality by using different camera perspectives to show how varied levels of detail in visuals can alter the perception of objects and events. In one photographic sequence, for example, the camera zooms in on the word "Bread" on a bread box and isolates the word "read" in a close-up view. In *Chinese Whispers*, Stokes and Douglas demonstrate that words and images can create a complex information structure with numerous dimensions in time and space. These dimensions, in turn, establish multiple channels of communication.

The use of photographs to define time-space relationships is one of the most interesting characteristics of artists' books. Michael Snow's book entitled *Cover to Cover* (1975) uses camera angle and perspective to establish multiple levels of time-space interaction. The book begins with a sequence of still photographs which document one physical action--a person walking through a door. Sequential photographs reveal different, but simultaneous perspectives of this activity. The first few photographs, for example, reveal the front and rear views of the person walking through the door. Then, when that action has been completed and the person is out of camera range, photographs show the two photographers who were documenting the action. Snow then uses one of these photos of the camera men to establish still another dimension in time and space. He creates a new photograph which shows the photo of the photographer being inserted into a typewriter. The image of the photographer, instead of serving as a source of documentation in the first action, now becomes an object in a completely different space-time activity. Snow's work demonstrates that visual media can establish a complex web of interaction between causal events by using multiple perspectives to alter conditioned responses to time and space.

Performance Art

In the 1970s, performance art became a catalyst for reflection and change in contemporary art. Artists working in this medium questioned the formal values of art and searched for ways to define new relationships between images, words, and sound. In her book *Performance Art: From Futurism to the Present,* Roselee Goldberg (1988) characterizes performance art as "a permissive, open-ended medium with endless variables, executed by artists impatient with the limitations of more established art forms."

Like artists' books, performance art highlights the limitations of traditional communication media by exploring alternative methods of expression. In the 1950s and 1960s, artists Merce Cunningham and John Cage established a momentum for innovation and change that became a philosophical foundation for many forms of performance art. Working independently and collaboratively, these two artists redrew the boundaries of dance and music by abandoning narrative interpretations and emphasizing the individual elements of design and sound.

Cunningham, for example, left the Martha Graham Dance Company and its focus on narrative dance in order to experiment with movement, design, and sound as unique aesthetic entities that could exist in their own time and space. His works forced the performers and audience to reevaluate the visual and conceptual relationships in the art of dance. In a work entitled *Dime a Dance* (1953), a random drawing of numbers prior to a concert determines what dances are performed to the musical score. If the dance is longer than the musical score, the music is repeated; if the music is longer than the selected dance, the music stops when the dance stops. This chance interaction between music and movement results in a unique performance at each concert and as a result, de-emphasizes the dance per se and focuses attention on the essence of movement, time, and the moment itself (Harris, 1988). Cunningham's works demonstrate that dance does not have to be perceived as a one-dimensional, linear art form that evolves over time into a unified whole. Instead, dance can exist as a multidimensional structure with simultaneous layers of perceptual activities, each of which unfolds as an independent space-time event.

Influenced by Zen Buddhism, John Cage, like Cunningham, developed art forms that challenged Western concepts of narration, logic, continuity, and form (Harris, 1988). He abandoned years of music theory based on harmony and established a music structure based on time. Intervals of time, in turn, were usually determined by chance occurrences derived from the *I Ching* (a Chinese method of throwing coins to determine chance numbers). Cage's works, ranging from his orchestral performance for "oxbells, animal jawbones, tin cans, and auto break drums" to his piano composition entitled *4'33"* (a 1952 composition that directs the pianist to sit silently in front of the piano for an interval of four and a half minutes) were designed to force the audience to abandon preconditioned responses to music and adopt a new level of awareness in audio-visual perception. His work, which integrates everyday sensory stimuli into artistic performances, serves as a reminder that art and communication are a reflection of the perceptual experiences of day-to-day living. Similarly, audio-visual media reflect the popular culture of contemporary society, and this interaction adds another layer of perception and interpretation to all forms of communication.

Cage's greatest impact on American art, however, was not a musical composition but a multimedia performance that he staged in 1956 at Black Mountain College in North Carolina (Harris, 1988). Entitled *Theater Piece No. 1*, Cage and other participants (including Merce Cunningham) simultaneously performed unrelated activities within specified intervals of time. There was no visual or thematic structure to the performance so each performer brought a unique level of artistry and design to the setting. *Theater Piece No. 1*, like Cunningham's dances, demonstrates that art and communication do not have to exist in a linear time-space continuum. Different perceptual activities can exist simultaneously in separate planes and create multiple channels of information that expand the levels of perception and communication.

Cage and Cunningham inspired other performance artists like Alan Kaprow and Robert Whitman to continue to chisel away at the restrictions that format, design, and media place on communication. In the 1970s and 1980s, performance art culminated in a new level of communication as artists, working to eliminate the boundaries between art, audience, and everyday life, began to make socio-political statements by creating works that integrated "high art" with symbols from popular culture. One of the most successful of these artists, Laurie Anderson, continues to stage multimedia concerts that comment on the dehumanization of modern society (Walsh, 1983). In concerts like the *United States* series, Anderson builds a perceptual framework for audience interaction by using a wide range of audio-visual tools, including words that are spoken or sung, realistic photographs, line drawings, motion video, hand gestures, and shadows of objects or herself. She also uses twentieth century technology (computer graphics, video editing systems, and electronic synthesizers) to modify the audio-visual stimuli and add a layer of social commentary to each performance. Janet Kardon (1983), curator at the Philadelphia Institute of Contemporary Art, uses the term "language objects" to refer to Anderson's earliest art--collages, etchings, artists' books, and small sculpture. This term, however, is also an appropriate description of her current multimedia concerts which emphasize the powerful emotional control that language, symbols, and media-generated information exert in the communication process. For Anderson, communication is often a "misdirected" exchange of information that uses the emotional impact of audio-visual media to divert attention from the critical issues of the world (Owens, 1983). By highlighting the political and social overtones associated with words, images, media, and technology, Anderson clearly demonstrates how sensory stimuli and popular culture help shape the psychodynamics of modern communication media.

Video Art

Video artists have used the technical processes of the video medium to create a highly spatial and temporal visual language. Two video pioneers, Nam June Paik and Bill Viola, established this new aesthetic by using audio-visual stimuli to alter preconceived perspectives of time and space.

Paik was the first artist to tap the potential of video as an artistic medium. He used magnetic devices to physically alter the video signal and create new forms of visual images. *Magnet TV* (1965) consisted of a television with a magnet on top that could be moved to distort the image. Later Paik created multimedia collages by juxtaposing text, sound, distorted and undistorted images, and diverse camera perspectives. In *Guadalcanal Requiem* (1977), a video commentary on the quest for independence on the Soloman Islands, Paik's brightly colored, distorted images occupy a flat, two-dimensional space that contrasts sharply with the realistic video footage of the three-dimensional island landscape. This contrast sets up a visual rhythm between color and texture that moves the viewer in and out of different levels of perceptual and psychological space.

Nam June Paik considered his work "time art" (Herzogenrath, 1988) and used video techniques to modify images and sound in order to alter the perception of time. In *TV Buddha* (1974) and *TV Chair* (1974), he used closed circuit television to juxtapose "real-time" video images with three-dimensional objects. In *TV Buddha*, for example, a statue of Buddha faces a television monitor showing video images of the statue. The juxtaposition of an activity that exists in a media-generated time and space with the actual real-world experience raises questions about the authenticity of communication media and challenges us to reevaluate our perception of reality--a perception that is based on the Western concept of a one-dimensional, future-oriented direction in time. Paik breaks from this Western philosophy and uses video editing techniques (closed circuit television, freeze frames, reverse action, fast forward, slow motion) to define diverse directions in time that evolve into a multidimensional network of perceptual and cognitive relationships.

Bill Viola also uses the video medium to alter the perception of time and space. In one of his most famous works, *Chott-el-Djerid (A Portrait in Light and Heat)* (1979), Viola uses the video camera to capture the visual distortions produced by the heat and light of the Sahara desert. He juxtaposes mirage-like images with real-life sounds and creates intricate webs of sensory associations which define different spatial and psychological environments.

However, the dominant theme throughout Viola's work is time. For Viola, time is a dimension that is not fixed or linear in direction, but a fluid element that is shaped in the memory of the viewer (Nash, 1987). Viola uses video editing techniques to create photomontages that redefine the perceptual and psychological structure of time. In *Ancient of Days* (1979-81), time runs backwards when a video sequence, depicting the burning of a pile of furniture, is played in reverse. In this same work, Viola creates a photomontage of the Washington Monument using 45 views that were recorded in one day from dawn to dusk. Changes in the position of the sun produce color variations in the sky and on the sides of the monument. Although the color shifts are subtle, the real-time playback of the individual frames creates an undulating movement in and out of the flat pictorial space. Time is no longer defined as a unique linear direction in space. Instead, time becomes a multifaceted structure in which visual symbols define an array of time-space activities.

Inspired by the pioneering work of Paik and Viola, other video artists are continuing to expand the perceptual and semantic network of the video language by introducing audience interaction into their work. The viewer is no longer a passive observer but a participant who establishes an inner dialog with the art. Mit Mitropoulos, for example, calls his art "video-to-video" installations (1991). In a work entitled *Face-to-Face 4* (1989), Mitropoulous uses the same closed circuit techniques that Paik used in *TV Buddha*, but he replaces the statue with two human beings. These participants sit back-to-back in the same physical space but see each other in a different perceptual space via video monitors.

Other artists are using interactive videodiscs to allow the audience to make decisions that will determine the outcome of a story or aesthetic experience. Lynn Hershman's *Lorna* (1983) is a landmark videodisc that opened the doors of this technology to other artists like Grahame Weinbren and Roberta Friedman, creators of *The Erl King* (1983-86). In these interactive video works, there are diverse levels of audience interaction ranging from objective observation to direct psychological identification with the video characters themselves. Other artists, like Peter D'Agostino, are using interactive videodiscs to encourage the audience to evaluate the impact of society and culture on communication. In *Double You (and X, Y, Z.)* (1981-87), D'Agostino allows the audience to investigate the relationships between word and images at different stages in the development of human language skills. In more recent works, D'Agostino forces the viewer to recognize the false sense of authority and credibility that is associated with electronic technology. For example, in a work entitled *In the Well* (1990), the audience is allowed to view the story of a boy who fell into a well by peering through devices, like a peep hole, that restrict perception.

Conclusion

Artists' books, performance art, and video art integrate layers of audio-visual stimuli into multidimensional networks where the user must make the perceptual leap to unify and structure the information. By studying these forms of contemporary art, information designers can learn to recognize the multiple levels of perception and cognition that exist in hypermedia communication. Ultimately, we can use these insights to develop effective communication models for hypermedia programs. These models, in turn, will lay the foundation for the next generation of computer systems--collaborative networks where multiple users with diverse skills and cultural backgrounds can modify common documents and databases. There are artists who are addressing issues in collaborative networking in a new art form called "telematic art." This type of art, like the art discussed in this paper, can provide important insights which will help information designers expand the potential of present and future communication media. The boundaries between information design and fine art are blurring as new art forms shift attention away from the art object per se and emphasize art as a form of interactive communication. In this philosophical arena, fine artists, graphic designers, and information specialists will find common ground for experimentation and collaboration. This synergy will produce a spiraling revolution in multimedia communication that will result in new forms of technology and new levels of interaction between individuals and organizations.

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Visual Literacy: The Esthetics of the Technological Age

Deborah Curtiss

Euclid alone has looked on Beauty bare.
Let all who prate of Beauty hold their peace,
And lay them prone upon the earth and cease
To ponder on themselves, the while they stare
At nothing, intricately drawn nowhere
In shapes of shifting lineage; let geese
Gabble and hiss, but heroes seek release
From dusty bondage into luminous air.
O blinding hour, O holy, terrible day,
When first the shaft into his vision shone
Of light anatomized! Euclid alone
Has looked on Beauty bare. Fortunate they
Who, though once only and then but far away,
Have heard her massive sandal set on stone.
- Edna St. Vincent Millay[1]

Since its inception in the 1960s, IVLA members have been dedicated to utilizing our most active perceptual organ, our eyes, to augment, reinforce, and enhance learning and experience at every level. To develop visual literacy theory, we have borrowed freely from our verbal language with its extensive vocabulary to research, discuss and write about many aspects and ramifications of visual languaging and communication. We gather together in this organization because of our interest in the interaction, both potential and actual, of the verbal and visual. As a result our work and teaching entails active participation in verbal and visual modes of thinking and expression.

Ideally we regularly and equally engage both visual and verbal activities to remain limber, to achieve a flexibility of mind and eye that is vital to visual literacy. The ability to readily and easily navigate the shift between verbal and visual is, to me, the keystone of being visually literate.

When attending two previous IVLA conferences, 1987 and 1990, I encountered visual expressions created by attendees, some spontaneous, others part of a session, that I perceived as visually indifferent and/or junky in appearance. Seeing them caused me to question whether appearance, specifically esthetic quality, is an integral part of visual literacy as I had assumed?

As a visual artist, continually engaged with visual expression, the esthetic component is challenging to address, for I approach the topic less as a scholar or theorist, and more as a humanist concerned with the effects of visual proliferation on the world in which we live. I am, moreover, admittedly biased. For example, I opine that we, especially as visual literates, have an obligation and a responsibility to integrate an esthetic component into every single visual expression we create, support, critique, encourage and use.

That said, and in its support, I will attempt to give a brief overview of esthetic theory and and its evolution to the pluralism rampant today; provide a justification of why we must continuously confront esthetic issues; and finally, realizing that few individuals today are educated or equipped to engage in esthetic analysis, give some approaches that I hope will be useful for addressing this issue henceforth.

In this age of multi-cultural pluralism and diversity, much that smacks of Eurocentric origin is suspect and, in some circles, "politically incorrect." It would be difficult to come up with a less Eurocentric concept than traditional visual esthetics. Even so, I attempt to make a concern for the esthetics of visual statements both acceptable and imperative.

As visual literates,
we have an obligation
and a responsibility
to integrate an esthetic component
into every visual expression
we create, support, critique,
encourage and use.

First, an unabashedly brief overview of esthetic theory. Immanuel Kant, in *Critique of Judgement* (1790), postulated ideal form to be so basic and far-reaching that, when we first contact other cultures, including extraterrestrial beings, we would be able to communicate with any such creatures through this "universal esthetic." Comprised of rhythm, pattern, grace, proportion, harmony, and so forth, the notion of ideal form dramatically exemplifies the Eurocentric esthetics I learned in college, and perhaps you did too.

While we've come a long way since the 18th century, many of these values prevail and continue to be taught predominantly, if not exclusively, by departments of art history and philosophy.

Born in Classical Greece, elaborated upon by the Renaissance and the Romantic era, and codified by the Bauhaus, traditional Western esthetic is predicated upon the concept of underlying structure, developed along the lines of ideal proportion–such as the golden mean–harmony of colors, contrast and variety, conflict and resolution and, ultimately, the unified whole. These concepts are so pervasive in our culture that all Westerners, educated in esthetics or not, use some form and degree of them to register preferences in everything from the choice of a new coat to admiring a car and reflecting upon the looks of the latest movie star.

Yet, when confronted by a Chinese, Persian, or Haitian painting, a native American petroglyph or sand painting, an African or Pacific Islander carving or, for that matter, any visual expression created by someone not raised with a Eurocentric perspective, we have few choices. Western art historians, critics and estheticians have tended to impose the Western esthetic on all art, a practice I decried in my book, contending that visual statements must be evaluated within the context in which they are created.[2]

With the phenomenal shrinking of the earth due to linkage via virtually instant visual communication, we don't have time to research the context in which a work is created. Moreover, with the melding of other cultures into that of the United States, particularly the surge of interest in African heritage and the influx of Asians and Latinos, we see the "other" now every day, and they are us. As a result, traditional esthetic values have been put into question, cast in doubt and, in some cases, discarded altogether.

In the name of "politically correct" multicultural diversity, confusion regarding esthetics can create a void in schools, art departments, schools of communication, and the culture at large, resulting in laissez-faire and evasive attitudes. The result is that visual statements are evaluated for technical and social qualities, while visual qualities are taken for granted, or merely given an existential nod. Visual elements, principles, and styles support the technical or statement-making aspects, but are given little further analysis or consideration as to how they contribute to the visual merit of the piece. Lamentably, the result can be an effusion of visual junk.

Why must we consider the esthetics of all visual statements? Why isn't non-critical inclusiveness appropriate?

Esthetics is frequently considered only in terms of what is beautiful, what arrests the eye. Yet traditional esthetic theory links the Good and the True with Beauty. However these three were combined in the past, we have seen how such rubric was expressed in visual art, and also dominated visual expression. With communications more limited and slower then than they are now, particular values could prevail for tens of years at a time.

Today, overwhelmed by pluralism, it is easier to judge esthetic qualities irrelevant than to deal with the multiple ways in which a visual statement may be evaluated for both its esthetic merit and its content. At the rate visual statements are proliferating, they rapidly lose value and their preciousness.

Yet, consider the consequences if we let this indifference continue unchecked. It would be to our impoverishment collectively, culturally, and personally. All would become ordinary as quantity would overwhelm and litter our lives.

I proposed this paper because I felt a need for the issue to be addressed, but before I knew what I was going to say. Fortunately I had several months between the proposal being accepted and actually sitting down to write, when coming and going in my daily tasks, I thought and questioned and questioned and thought, why is esthetics so important? Where do my own values come from? True, I was raised and schooled in European esthetics, from Plato to Dewey, from Giotto to Albers. But I also had the experience of eschewing those values to more deeply understand Chinese ink painting which I studied assiduously in the 1970s, later inviting Zen-like attitudes and chance approaches to my own work. At the same time, I am constantly making decisions based upon visual information. Decisions of placement and relationship, choice of palette, scale, dynamics.

WAYS OF INTERPRETING VISUAL EXPRESSION

Connoisseurial
Iconographic
Social
Structuralist
Semiotic
Deconstructionist

Visual literacy entails inclusive consideration of all approaches

All the while I look at a lot of art, study it, enter into relationships with that which is being created in the moment. As an artist, I have no limitations placed on me today as to what an art work should be made from, how it is categorized in terms of medium, or even how it should look. We have no evident standard to assess the merit of an art object. As a result, hype from gallery directors and museum curators, themselves swimming in a sea of ill-defined possibilities, latch on to that which is new and tout it above other considerations. With such richness, we nevertheless seem perpetually on the brink of exhausted novelty.

I can speak personally, and have to many of you already,[3] about my own motivations to do what I do–paint paintings of figures, dreamscapes and botanical forms–in order to say something I can say no other way. But what can I say that would give a key to evaluating esthetic merit of visual statements in all media? In a moment of insight, I remembered, while drawing the figure, the pure magic that dwells on the inside, that which enabled him to stand there before me in all his glory.

Have you ever drawn a bone? Any bone–chicken, lamb, or human. A single bone, as form, is pure miracle. It has no geometry, no regularity. If you draw it, you soon realize that any point along its edge, extended into a line, follows contours that are perpetually changing. Changing in every direction. Changing, moreover, at changing rates of change. Yet this structural element, for all its irregularity, relative to its weight and mass, is one of the strongest substances known.

Where would we be, with no bones or skeletal frame? Without getting grotesque about puddling blobs along the floor, I inevitably must, based upon recognition of this vitally important, complex underlying structure that we all share, postulate that underlying structure, also known as articulate form, is critical and essential in all that we make and do. Visual statements, whether a building or an etching, are no exception.

How do we discover the underlying structure of a visual statement? Any of us who have studied basic design or read visual theory is aware that visual statements are comprised of the elements as the alphabet, and principles, the syntax or grammar, of visual statements. When we deconstruct a visual statement, and I use the word deconstruct here not in its postmodern application, but in its original sense of taking apart to discover constituent parts, we can learn a great deal about how the image or object was constructed, which of the various principles of organization were utilized, how they were used, and how they relate to both one another and to the whole of the visual statement.

Just as a new sport is learned with warm-up and training, a skill such as visual analysis must be learned and practiced. The method I have found to be particularly useful, especially for non-practicing artists, involves using pictures cut from magazines. With tracing paper overlays, each compositional principle may be extracted, one by one from the image as a whole. For example, a visual statement may be analyzed for its use of symmetry: bilateral, rotational or transpositional. Its implied central vertical axis, assessed by deciding relative visual weight of the picture on either side of it, can be determined and drawn. Around this central axis, focal points can be highlighted. Always, the frame of the image should be included, for all principles interact relative to one another and relative to the whole. At this point of the analysis, in a good visual composition, this design: frame, central vertical axis, and focal points should, by itself, be a good, simple design–one that is balanced, well proportioned, and suitable to the content of the image. For example, a visual statement that must be dynamic and attract attention, can have a less stable structure, while one that you would want to frame and live with, will most likely have an underlying structure that is somewhat quieter.

Only when doing this with a variety of images does one develop rapid visual assessment of the structure of a visual statement. It is like developing x-ray vision. You wouldn't want a surgeon cutting you open who had never dissected a cadaver and performed surgery on practice animals, then apprenticed under supervision for a number of years. Similarly, just because perception of visual statements is virtually instantaneous doesn't mean that analysis of them, developing the ability to look beyond surface meaning, is instantaneous as well. Like any skill, it must be learned, and it must be taught.

Yet, structure is not the only framework for visual excellence. Art of other cultures, Oriental, African, Native American, and Island, for example, may be steeped in allegory, metaphor, ritual, spirituality and that which is poetic. In these instances, structure can play a minor role, yet the work evokes the ineffable whatever that makes art ART.

Thus, learning to see beyond appearances into the structural and/or poetic aspects of a visual statement can place us firmly in the realm of potential esthetic merit. In most visual statements, if good structure is not there, no end of pretty colors, bravura tech-

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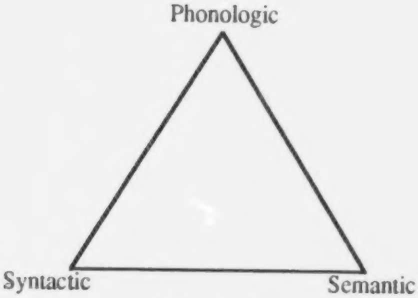
nique, or awesome subject matter will create a visual statement worthy of more than a cursory glance. The exception is that which, due to its content and the power thereof to communicate, achieves transcendence through meaning and shared value.

As mentioned earlier, many concepts of visual literacy and visual languaging have been borrowed from verbal literacy and linguistics. Language is commonly thought to be comprised of three aspects:

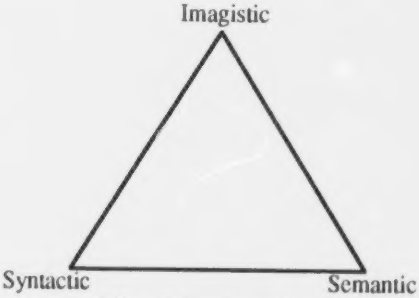
Phonologic: sounds, letters, words
Syntactic: grammar, composition
Semantic: meaning, interpretation

One can similarly make a case for visual languaging as comprised of three analogous aspects:

Imagistic: visual elements, icons, symbols
Syntactic: compositional principles
Semantic: content (subject matter, meaning), interpretation.



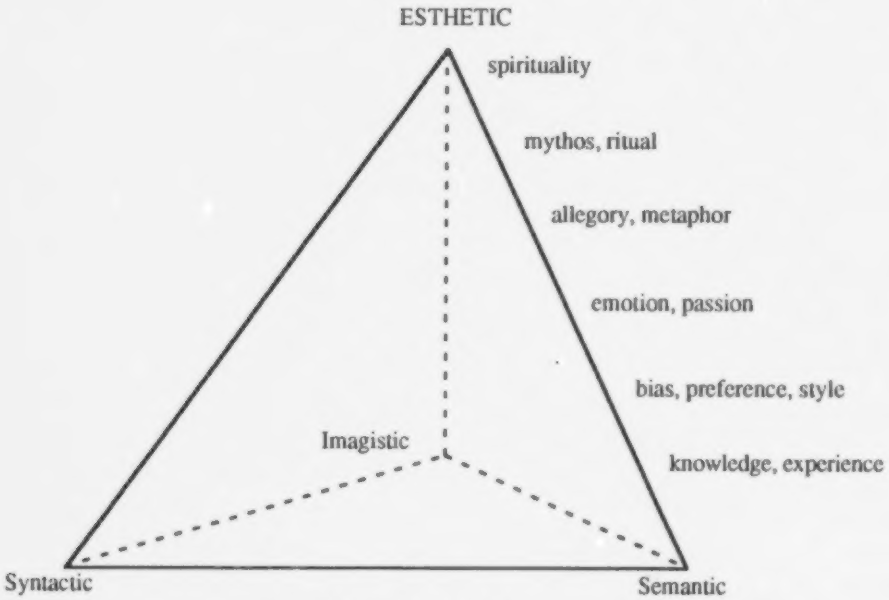
Linguistic
Model



Visual Languaging
Model

Left there, both verbal and visual languages are flat, two-dimensional.

In thinking about the role of esthetics in visual literacy as a fourth point or realm, I sensed it would be more than a simple flat square:



Visual Literacy Model

Thus we have a tetrahedral model in which the poetic/esthetic are essential components. The added dimension significantly enriches and elevates both verbal and visual statements. The esthetic apex (poetic in a verbal model) includes, as well as the good, true and beautiful, considerations pertaining to emotion, bias, preference, style, allegory, metaphor, myth, ritual, and spirituality. It encompasses all that we are as sentient beings, and can contain the entire realm of feeling, knowledge and experience. Each of the edges of this tetrahedral model has its own components, weighted according to the imperatives of the visual statement maker. The interior is a Gestalt of profound interaction.

While finding the elegance of Euclid and the Platonic solids phenomenologic wonders, I'm not fond of the rectilinearity of this model. The compulsive creative in me prefers something more free-form and flexible–which is why I do what I do . . . Nevertheless, the tetrahedron serves as a graphic example of the quantum enrichment that adding a new dimension, in this case the esthetic component, brings to visual statements.

In this spirit, can we, as the self-appointed visual literates of the world, recognize that visual literacy can be **the esthetics** of the technological age. In its generic approach to all that is visible, visual literacy enables us to look at all visual statements, irrespective of medium, through the power and efficacy of enlightened visual perception and communication ability.

When we present ourselves to the world as visual literates, and teach visual literacy to our students, we have a special responsibility to address, generate and incorporate the esthetic component, not as an afterthought, but as an integral part of visual communication. We must evaluate esthetic merit, think about esthetic issues, include an evaluative, context-relevant approach to all visual expression, and to teach our students, from preschool onward, to do likewise with regard to both their own work and that of others. To do any less is to shortchange ourselves and besmirch the intent and power of visual literacy. Who knows, we may indeed arrive at an esthetic that bridges across cultures and is at least worldwide if not universal.

> Who, if I cried, would hear me among the angelic
> orders? And even if one of them suddenly
> pressed me against his heart, I should fade in the strength of his
> stronger existence. For Beauty is nothing
> but beginning of Terror we're still just able to bear,
> and why we admire it so is because it effortlessly
> disdains to destroy us.
>
> - Rainer Maria Rilke[4]

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[1] *Collected Sonnets,* N.Y., Harper & Row Perennial, 1917/1970, p. 45.

[2] *Introduction to Visual Literacy: A Guide to the Visual Arts and Communication.* Englewood-Cliffs, NJ, Prentice-Hall, 1987, p. 59.

[3] Curtiss, Deborah: "Evolution of a Vision," *Journal of Visual Literacy,* 8:2, 1988.

[4] Rilke, Rainer Maria: *Duino Elegies,* "The First Elegy." N.Y., W.W. Norton, 1939. Translation my own.

VISUAL LITERACY: THE ESTHETICS OF THE TECHNOLOGICAL AGE

The Use of Color and Motif in Korean Shamanism Folk Art

Ann Cunningham

Korean Folk Art, a term used interchangeably with Decorative Art or Handicrafts, encompasses a wide variety of subjects and objects ranging from architectural painting of palaces and temples to embroidered cases for eye glasses. As in most advanced early cultures, numerous artifacts and studies indicate that the use of certain colors and motifs in Korean art is influenced by the religious belief at the time of its creation. Since 2,333 BC, the legendary year when the mythical founder Dangoon established Korea on Mount Baekdoo near the Yalu River, its people believed that they were the decendants of the Sun God. Such belief was reflected in their traditional costume of white, symbolizing the rays of sun, and later as puritanism.

Shamanism, one of the earliest forms of religious beliefs which carried specific ceremonial rituals, presumably was originated by different clans of various geographical territories. Principle ceremonies were initiated to drive away evil spirits, prevent illness, and bring good fortune to the family. This religious cult, which still exists in the urban communities of Seoul, has proliferated since 400 BC during the Mahan Period (Lee, 1976, p. 148). Each object used in a ceremony represents a specific role in the ritual, based on the teachings of shamanism, and thus was created with care. Some of the methods used in combining certain colors and designs to create special messages of the early days are seen today in objects such as jewelry, trinkets, household ornaments and accessories, and formal wardrobes.

In the beginning, China played a significant role in the development of art, literature, and religion in Korea. Although Korean art was influenced by China in the early periods, Koreans have developed their own style and characteristics which is spontaneous, delicate, and closely related to their daily life, which often bear colors and motifs generated by religious teachings. For instance, architectural painting style was adopted from Confucian hierarchical concepts of social classes emphasizing harmony and balance. Old palaces and religious compounds are painted with layers of colors in horizontal planes to achieve such effects (COMPASS Readings. March 1991). Buddhist art treats and glorifies humans as co-equal with the rest of the universe by gilding statues with gold and enlarging them to monumental sizes. Certain shamanism followers, on the other hand, consider other objects and animals as important as humans by worshipping animal figures as gods and even sacrificing humans to satisfy their chosen god's calling.

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Korean Shamanism, referred to as 'Moogyo', has been considered a forefather of Korean Buddhism by some theorists of religion. Shamanism took its shape and flourished during the period of the Three Kingdoms (40 BC-680 AD). It became the state religion and shamans enjoyed the privileged lifestyle of statesmen by acting as an oracle on behalf of the king. However, as Buddhism, Confucianism, and later, Christianism were established, shamans were relegated to the lowest stratum of society (Gaper, 1984). Until recently, due to harsh treatment of shamans by others in society, their values and historical significance were virtually ignored, and very little attempt was made to record the facts and events of the shamans and shamanism in Korea.

This report is prepared to introduce the theoretical aspect of shamanism and its influence in traditional Korean art. The main purpose is to examine the relationship between the use of color and motif in folk art objects and the teachings of shamanism. This is achieved by reviewing six major ceremonial rituals, describing the objects used for the rituals, and summarizing the significance of the color and motif used in objects as a means of visual communication.

Korean Shamanism

The interrelationship between religion, art, and culture in Korea is much more intricate than many believe it to be. It has been an integral part of the daily life of the average person of the country. Studies indicate that the shamans' spiritual dances formed the basis of folk dancing, methods of spiritual-invoking provided a beginning of stage-acting, and the techniques used in the production of ceremonial objects are seen in many branches of the visual arts. Such factors are reflected in Korean folk songs, dances, and costumes where different regions have different sets of traditions (Lee, 1976).

The proper term for Korean shamanism is 'moo-ism' or 'moo-sok', a primitive religious phenomena, where existed a 'Bear Cult' and 'Sun Cult'. The word 'moo', written in Chinese, stands for two people dancing before the king. Early shamanist's apothegm was "dance in the Court and sing together at home." Various forms of traditional Korean performing folk arts have evolved from this tradition of song and dance. It is a complex cultural development which is often referred to as a 'borrowed religion' because various rituals and teachings are influenced by Confucianism, Buddhism, and Taoism. The forms of rites and rituals have changed over time, reflecting such influences. Needless to say, these changes have had a profound effect on the many aspects of Korean society and 'popular culture' at the time of its existence (Lee, 1983, p.253).

A shaman or a sorceress called 'moodang', usually a woman, works between the god and his/her followers within the four constituents; ideological guide, mediater, inspirator, and communicator. The birth of a shaman occurs to an individual of any age at a random place and time, usually in the midst of an intense ceremony. A person mysteriously falls ill during or after the ceremony and cannot be cured unless a series of shamanistic rituals are performed and the patient is converted into shamanism. This Shaman's Illness is known as a mystic power transfer process from a performing shaman to the person who fell ill. The patient accepts the process and becomes a shaman as a god given occupation. Another way to become a shaman is to inherit the role from mother to daughter. Both types of shaman enter similar training to learn the practices of a shaman.

Shamanism, though regarded as unreasonable and superstitious by the standards of Confucianism and Christianity, established a close tie with Buddhism, and became something fundamental in the ethnic consciousness of Korean people. The belief system was widespread in China, Mongol, Manchuria, and Siberia. Hence, there exist enormous variations of rituals, symbolic gods, and even purpose of the very existence of shamanism among different groups of followers in Korea. For example, 'mu' followers belong to Siberian shamanism; therefore, their rituals and chosen gods are related to those of a cold and barren environment. They use ceremonial food and objects different from those used in mountainous regions or seaside ceremonies (Cho, 1985).

Rites and Rituals

Shamanistic rituals called 'goot' range from a simple one-hour praying activity to an elaborate process that requires weeks of preparation and performances. Typically, a shaman carries out her performance in a set-up where walls and entrances are decorated with pictures of the Great Spirits and Heavenly Goddesses of numerous colors and designs. The spiritual dancewear, headpiece, musical instruments, and other paraphernalia utilized for the ceremony vary depending on the purpose of the event.

Rituals are categorized into two main forms; those initiated by individual requests, and others performed as group activities. Individual requests are made when someone becomes ill, wishes a son, or needs a lingering ghost of the dead sent to the after-world. Group ceremonies are used to perform rain dances, to ward off demons in a village, to celebrate a good harvest, and to bless a shrine's existence by helping people to meet their many needs and enabling their wishes to come true. These ceremonies are performed in private homes, village shrines, or central temples in different regions. Today, however, a significant number of ceremonies are performed at large ceremony centers in Seoul where popular and prosperous shamans live. Unlike many rural shamans whose main role is to perform rituals only, shamans in Seoul play fortune-teller and advisor, in addition to the traditional roles. There are as many rituals as the number of needs and wishes. Nevertheless, each ritual can be placed under six main ceremomial categories. The following are further descriptions of these six ceremonies (Kim, 1986; Lee, 1976, pp.146-152; Chun, 1976, pp.62, 122-134).

1. Naerim Goot (Initiation Ceremony):

   This ritual is performed strictly for those individuals who enter the profession of a shaman. Oftentimes, the rituals are repeated until the person is completely cured from the Shaman's Illness, which means she is totally submitted to the god and becomes a 'dedicated' shaman. Those individuals who are not 'dedicated' are treated as witches whose practice of medicine is ineffective and may even bring death to a family. The rituals are held at the patient's home in the beginning, but are moved to a sacred place chosen by the Mother Shaman (performing or instructing shaman) for initiation.

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2. Ogoo Goot (Consolation Ceremony):

The consolation exorcisms are to pacify and dispatch the spirit of the dead to the after-world. Many people believe that a ghost of the dead appears before a living person because the dead has either 'unfinished' business with a person, or has a fervent desire to remain with a person in the present-world. A shaman contacts the spirit through songs and incantations, communicates with the spirit, and converses with the individuals involved with the spirit. The shaman continues to communicate with the spirit via songs, dances, and more scripture-reading until she senses the spirit is satisfied and has disappeared. Sometimes the spirit reappears and requires a much more elaborate and costly ceremony.

3. Choogwon Goot (Blessing Ceremony):

The main purpose of this ceremony is to provide a periodic (usually annual) gathering of all the people in the community (including non-shamanists) for feasts, entertainment and games. Such events are carried out all night long, and can last for days. There are other smaller scale celebrational ceremonies. For example, a gathering for someone in a shamanist's family who became a distinguished scholar or high-ranking government officer through an extremely competitive exam. For these occasions, an informal party follows after a brief shamanistic ritual.

4. Sungjoo Goot (House-Guarding Ceremony):

This ceremony is initiated at a ground-breaking to prevent adversaries during the construction of houses or other structures by disturbing the ground that may cause supernatural interferences. Intermittent ceremonies may take place when a ridge or cross beam is put up. The final ceremony may be performed upon completion of a building.

5. Chilsung Goot (Seven-Star Ceremony):

Shamanist women who wish to bear a son or the first child prepare a special table with a bowl of pure water, place the table at the north side of the house (facing the seven-star, or the Big Dipper), and pray for an hour at dawn for 100 days. Similar methods, with a shorter length or less frequency is used to pray for a child's health and longevity. The ceremony takes place at the beginning of these praying sessions. There are a series of activities that are prohibited while a woman is in the praying period; evil-thinking or speaking, entertaining men other than her husband, and drinking, to name a few.

6. Simoo Goot (Medicinal Ceremony):

Before Chinese and Western medicines were avilable, most Korean people relied heavily on a crude form of shamanistic treatments where the shaman performed rituals and prescribed herbal medicines. Later, during the Chosun

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dynasty, some shamans worked as doctors, by combining rituals and Chinese medicine in government sponsored regional care centers where hundreds of patients were being treated. Patients included not only those who were considered affected by a spirit, but also the genral public with common infections and diseases.

Ceremonial Objects

Each ceremony is composed of 12 small ritual segments or procedural steps. Usually each segment is carried out in the same setup, but with different costume, scripture reading, song, and dance. Many of these short ceremonies are derived from folklore or legends and resemble on-stage performances. Such performances are combined with incantations, spiritual music, and dance. Depending on a family's other religious belief, a brief Buddhist or Confucious ritual takes place before any shamanist ceremonies.

Instruments and accessories used for each segment of the ritual vary. Commonly used objects for the rituals and and ceremonies are, a sword, a brass rattle of bells often attached to a fan, guardian portraits of gods and goddesses, amulets, lanterns and flowers made of colored paper for sanctum decoration, and a sacrificial table with food and brassware. Musical instruments utilized during these ceremonial activities include drums, flutes, fifes, pipes, gongs, and rattles of numerous sizes, shapes, and materials (Whang, 1990).Depending on the type of ceremony, geographical location, and family origin, additional items are placed around the ceremonial stage and surrounding area. For example, effigies of a child made of rice paper are displayed during a Chilsung Goot. Dolls of persons, deities, animals, and gods may be used for several other ceremonies. Long strips of white cloth, signifying the road to the afterworld,P are held by relatives when sending away a wondering spirit during a Ogoo Goot. Sometimes one group of shamanists place different portraits for an identical ceremony of another group because their Village God or Family God is different than others.

Regardless of purpose, each group of ceremonial objects contain specific images and colors that are considered sacred and important in communicating with the spirit or god. Most popular images are ten long-living animals in legends or in real life, such as dragon, crane, mountain lion, turtle, phoenix, peacock, etc. Favorite plant images adopted by both Buddhists and Shamanists are lotus, water lilies, irises, and peonies. These images have become favorite subjects by painters, decorators, and jewelry designers today because of their beauty in color and pattern.

Korean Shamanist Folk Art

The tradition of creating sacred and beautiful images has been passed on for many centuries among all people, not just among shamanists and Buddhists. Common people also believed that such images contain special meaning and bring good luck. Therefore, the use of certain motifs and colors have become routine practice by craftspeople who design household accessories, furniture, trinkets, and embroidered clothes.

There are various sets of colors, motifs, and deities (sacred images, or immortal figures of men and women) utilized for different art objects and paintings . Techniques used for architectural painting, for instance, may differ in color scheme of the same image painted on a ceremonial fan used by the shamans. A royal palace was usually constructed with ornate wooden eaves, cross-beams, and window trimmings. Each curve and corner was painstakingly hand-painted, then gilded. Shrines and temples were less ornate in construction, but the colors and designs adopted were just as sophisticated. Schools and civil offices were considered less significant and were constructed with less decoration.

The Use of Color

Although the use of the color white was deeply rooted in all aspects of life for many generations, a complex color system began to emerge when their culture and civilization began to be influenced by shamanism. Furthermore, the development of the use of color and design became even more complex when other religions came into play in the lives of Korean people. These color systems and symbolism generated from ceremonial art objects became the main source of visual communication by combining them into different ways to create special messages which are used in many areas of decorative arts in Korea today.

Theoretically, traditional Korean folk arts are divided into two main categories. There are feminine or Yin art subjects which include those utilizing thread or yarn such as embroidery and knot-tieing, and the masculine or Yang art which refers to those utilizing painting mediums. In either case, they begin with five basic colors. Five colors signify the five astronomical locations, and seasons, and then they are interpreted into subjects and deities described in the teachings of Buddhism, a basic concept adopted by shamanism as well. The following table is a further interpretation of the five colors (Im, 1990, October).

There are three primary colors most frequently used in many branches of decorative art; gold (the Universe), blue (Yin), and red (Yang), that were adopted from Buddhism. A basic color wheel for traditional artisans contains fifteen colors; five basic colors, five intermediaries, and five tonal variations. Those fifteen frequently used colors are;

figure 1.

COLOR	DESCRIPTION	SEASON	LOCATION	DEITY
Blue	Water	Spring	East	Blue Dragon
Red	Fire	Summer	South	Peacock
Yellow	Wood	-	Center	Heavenly King
White	Gold	Fall	West	White Mountain Lion
Black	Earth	Winter	North	Warrior

blue, red, yellow, white, black, ultramarine, yellow-green, thalo green, turquoise, crimson red, orange, cerulean blue, powder pink, and gold,

Commonly used motifs and patterns in painting and visual display objects include; clouds in five colors, four spirits from each astronomical locations, seven treasures, twin dragons, twin phoenixes, birds of paradise, and cranes. These motifs and characters often came into being from legends, and were combined in a way to create an atmosphere and message most appropriate for a certain building's existence or an event . While motifs' revelation evolved around legends, theories behind the use of selected colors are rather literary. Bin-hu-gak Lee, a scholar during the Chosun Dynasty (1392-1910) compiled a form of imperial almanac. In the book, there is a section titled, "Techniques of Dyeing" where he interpreted some of the logics of nature and arrived at convincing rules of color schemes used in Korean decorative arts (Im, 1990, October):

> Metal (white) is stronger than wood (blue), therefore call light blue an intermediary; Wood (blue) is stronger than earth (yellow), therefore an intermediary color is green; Earth (yellow) is harder than water (raw umber), therefore an intermediary color is burnt sienna; Water (raw umber) can win fire (red), therefore, an intermediary color is orange; and Fire (red) can destroy metal (white), therefore, an intermediary color shall be pink.

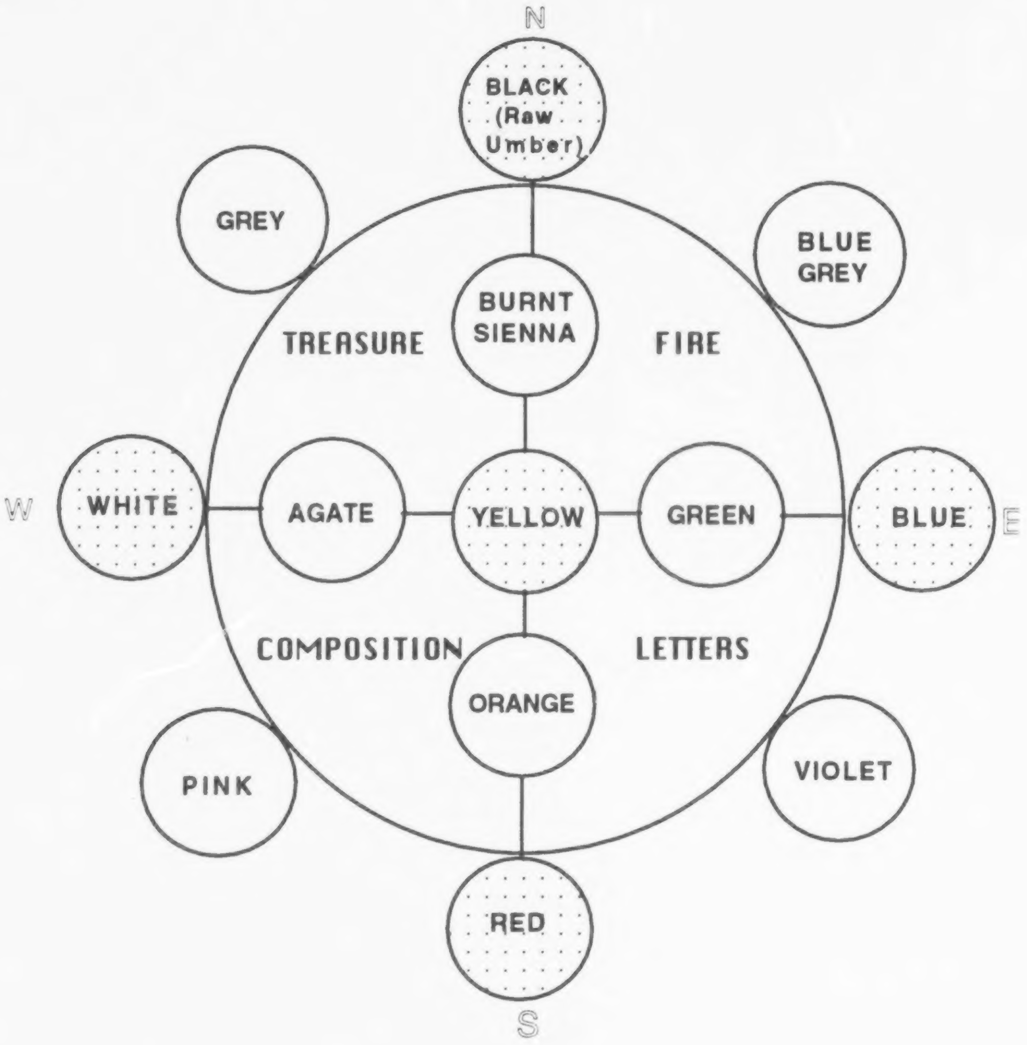
Interestingly, some of the colors, wood and water for instance, were perceived differently by Koreans in those days than the colors we know of today. Perhaps this is due to the fact that a forest from a distance appears blue, and a mass of waters flowing mixed with a large amount of earth during a flood makes water look brown instead of blue.

Each of these colors was produced from natural substances such as seeds, flowers, tree bark, roots, and fruits. The colors were much more vibrant and delicate than colors now produced from chemicals. Production of colors of natural substances to meet the needs of specific projects required skillful hands and minds. The process depended heavily upon a trial-and-error technique that was very difficult to master. Traditionally, the craftsmanship was passed from father to son or a selected group within a community; hence, the practice become lost when later generations disintegrated and failed to pass it onto others. As a consequence, the technique is rarely used today and the quality does not meet stringent standards that once existed.

Apart from an artistic point of view, the use of colors in decorative art extended to other aspects of society, some of which are still traceable in Korea today. Lee, the author of the imperial almanac, made parallel interpretation of the five intermediary colors into five astronomical locations in relation to the main four locations, and into socio-cultural symbols. This can be illustrated in figure 2.

Historically, individuals in certain professions wore wardrobes of specific colors identified by this color system during the Chosun Dynasty. The court scholars wore shades of violet while government officers wore shades between black and white. Today, such tradition can be found at some college graduation ceremonies where a person who receives the highest degree in letters wears a gown with a violet stripe while a graduate in music wears a gown with a pink trimming. The use of royal colors can be seen in an elegant hotel's waiting staff who are dressed in crimson red to boast the imperial qualities of their services. Strangely enough though, white costumes, worn by all common people earlier, now became a mourning garb. It is said that the color white stands for purity and the beginning point, therefore, a color to be worn to send a spirit to the beginning of another life.

figure 2.


N
BLACK (Raw Umber)
GREY
BLUE GREY
BURNT SIENNA
TREASURE
FIRE
W
WHITE
AGATE
YELLOW
GREEN
BLUE
E
COMPOSITION
LETTERS
ORANGE
PINK
VIOLET
RED
S

The Use of Motif

It is assumed that the use of motif originated from the drawings in caves and paintings on the tomb walls of kings and queens. Earlier evidence indicates that the paintings were created to record events and activities, but later included images identified as guardians. Although it is not clear why, how, and when certain images of tomb painting or mural were transferred into religious art motifs, there exists ample examples of such coexistence of the same or similar images in a variety of artifacts.

For example, multiple layered cloud designs seen in a cave mural created during the Koguryo period (37 BC-668 AD), are used in many shamanist god paintings and Buddhist temple decorations. It is believed that such images are identified as heavenly and protect common subjects from evil effects. Other heavenly images people worshiped are blue dragon, white tiger, black turtle, red phoenix, and mountains (Ha, 1968, p.77). Today, these designs are combined with Confucious writings in embroidered wardrobe accessories to be worn by women as lucky charms.

Traditional Korean motifs may be divided into seven categories: plants, animals, imaginary plants and animals, nature, good omen symbols, geometric forms, and human figures. Most frequently used scenes are clouds, sea waves, and mountainscapes. A bulk of geometric motifs are comprised of Heaven and Earth, Sun and Moon, Mountain and Water, and Thunder and Lightening. They are intended as a means of communication with the High and Mighty (Im, 1990, July). These images are usually designed in a circular form or in a repetitive fashion that signifies harmony, continuity, and eternity, the main principles in the teachings of Buddhism (the wheel of law), and Confucianism. Such principles are adopted by shamanists and many of their ceremonial decorative objects and paintings contain combinations of those images, motifs, and symbols. For example, a Chilsung God portrait may include seven human figures, multi-layer clouds, and a mountain lion, sitting on a row of lotus blossoms.

Many of these motifs are used alone when utilized for decoration only, especially in architectural painting. More often than not, they are combined with Chinese characters and other motifs in order to create an art object for a special purpose. For instance, shamanist paintings of Taejoo (the Great Spirit of the Heaven) and Myoungdoo (the Holy Goddess), to be placed on the left and right side of a shrine's entrance, may consist of similar background composed of the same motifs, but the figures and writings differ. Sometimes the paintings at the entrance or walls are repeated on the fans used for rituals, except that some of the motifs are deleted or simplified.

Summary

Despite the fact that there exists a substantial amount of information on Korean Shamanism and Folk Art, very little is known to Westerners because the majority is written in Korean. This report is compiled in an attempt to bridge such a gap by providing some of the data recently collected by scholars and researchers. Nevertheless, they are not conclusive studies by any means. Much of what is available today depicts contradictory views between authors. This is imminent when considering fact that a notable investigation of the Korean Shamanism did not take place until 1900's (Cho, 1985, p.22). Until then, researchers had to rely mostly on field research and spoken history told by village elders, and, quite naturally, each village's story varied.

Investigating the relationship between art and shamanism is even more difficult for a simple reason. The status of shamanism as a religion in Korea has never been established. Shamanism has long been treated as a sub-culture of Buddhism, a cult, or as a branch of folk art. Hence, no evident effort was made to isolate shamanism from other religions, or to study art objects that are entirely shamanistic. Nonetheless, there are qualities in shamanistic art objects which may be distinguished from other religious art. For instance, expressions and colors of paintings are intense to a point where they appear threatening or fearsome. Techniques of their drawings are rather crude with heavy contour lines. While motifs in Buddhism are used mainly as symbolism or embodiment of scripture, shamanists used them sparingly as embellishment.

Inasmuch as the shamanists' main concern is to communicate with heavenly subjects, their visual messages use colors and motifs to represent mystic power of the unkown world. Art and ceremonial objects were sacred and showed the level of devotion, and as the needs became sophisticated, so did the art forms. There are many intriguing aspects in shamanism which need to be explored in order to clear misconceptions and to promote better understanding of Korean Shamanism and folk arts. Furthermore, it is essential to make an on-going effort to ascertain effects of religion in art, and to establish a solid foundation for other related studies in the future. This is only a preliminary study and a series of reports are to follow which examine religious attributes in Korean decorative arts.

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Screen Images: Where Are the Real African-Americans?

Carmen Coustaut

We Americans in 1991 are a society that is visually literate. We possess very advanced technology that assures every segment of our society exposure to and training by very specific visual communication. We are bombarded constantly with images which guarantee that we see and learn a perspective of the world that is established by various media, especially film and television.

Also, we are a very culturally diverse society. However, most cultural groups exist outside of the mainstream, like African-Americans, Hispanic Americans, Asian Americans, Native Americans, women, people with specific physical characteristics that result in difference -- any group that finds itself excluded in some way. In fact, we begin to question what is the real mainstream; we begin to question who is the real mainstream; and we begin to question if, in fact, there really is a mainstream. After all, who is left to comprise this so-called mainstream society? What is important for us to understand, however, is that the concept of a mainstream is very powerful because it sets the standards and defines what is successful and good as well as what is negative and unworthy.

So when we look at the images we have at hand, we must ask "Do these images (and the resulting attitudes) bridge cultures?" If we think of mainstream society as a mainland, we have a variety of cultural groups that exist as islands surrounding the mainland. These islands have bridges that connect them to the mainland, but I must say that these bridges are only one way -- that is, the direction that the image travels is from the mainland to the island and not from the island back to the mainland. In other words, as diverse cultures, we receive images from mainstream society, but mainstream society rarely receives images from us.

Certainly, we seldom have bridges that connect island to island, so even those cultures that may have much in common, rarely share those traits with one another. Our society is one of a series of separate groups all orbiting around a main group, but rarely coming together as one. The notion of the "melting pot" could not be more erroneous, and it certainly is not translated to the visual image in terms of accurate representation.

When we think of the advertising industry, for example, we find we have access to certain images in all forms of visual communication: newspapers, magazines, billboards, television, film. What we find there, however, is a certain pre-defined way of seeing -- not only the images presented to us on a daily basis, but a definition of how we must see ourselves.

Women, for example, are portrayed very often in a variety of contexts. The images of women tend to define a notion of beauty that is applied to women throughout the country, if not throughout the world. But there is a distinct problem with this notion. Not all women are in their twenties; not all women have blond hair and blue eyes; not all women are ultra-thin or have similar body structures; not all women are the same height; not all women have the same skin coloring; not all women have similar features; not all women have wrinkle-free skin; not all women have long, flowing hair.

That isn't to say that contact lenses, hair relaxers, hair dyes, skin creams, make-up, diet programs, cosmetic surgery and so on and so on and so on, can't help conform the woman into what is perceived as the notion of a beautiful woman. But these remedies are costly: not only in terms of money, but also in terms of health, and often in terms of self-esteem. Rather than celebrate the different types of beauty among various women, the image-controlled advertising industry would rather we spend billions of dollars trying to conform to a "type" of beauty -- a standard externally set -- that often violates the very essence of who we are. In fact, when we look at the women themselves, the models who are used to promote these images of beauty, one wonders what they actually looked like originally, especially since these women undergo harsh treatment to "look" a certain way.

Most groups of difference have suffered misrepresentation in the media. The history of the visual image has portrayed other groups in negative and unrealistic terms. The impression construed was that if one could not hear, one could not think. If one could not physically see, one could not know. If one could not move in a certain way, one could not lead a rich and full life. These kinds of fallacies work havoc on the way society in general perceives groups of "others," and although much of my discussion today focuses on the historical representation of the African-American community on the film and television screens, many other groups will be able to identify with similar experiences of exclusion and misrepresentation.

From the earliest films in the history of American cinema, the image of Black people has been limited to those roles that have been of service to or a threat to the dominant group. Films like the notorious *Birth of a Nation* made by D.W. Griffith in 1915 successfully depicted society's notion of Black people, and established a visual rendition of this group for decades to come, including the present decade. Set in the historical period just before, during and right after the Civil War, these early screen images consisted of Blacks as faithful servants, as buffoons, and as jolly, happy, ignorant and innocent souls requiring guidance. Furthermore, this film portrayed Black men as savages, sex-starved brutes, vicious criminals needing containment by white heroes, such as the Ku Klux Klan. Black women were no more than mammies, maids and mistresses.

At first glance, to look at *Birth of a Nation* from a contemporary perspective, one may find these images so absurd as to be ridiculous. For example, there is a scene depicting Blacks as the majority in the state legislature during reconstruction. But Griffith's view presents an ensuing pandemonium that portrays the Black representatives barefoot, eating fried chicken, and drinking whiskey. The business at hand is the Black men's advocacy of legalizing interracial marriage. Of course, the only thing on their minds with the winning of their freedom is the desire to marry white women.

These are but a few examples of the way Griffith's film depicts its Black characters, who, by the way, were played by white actors in blackface. D.W. Griffith is still heralded as the father of narrative cinema, and this film is celebrated for its technical advances of cross-cutting, camera movement, camera placement, fast-paced editing, etc. But the images of its Black characters have been branded into the consciousness of American society.

These ludicrous images can be read as amusing in 1991 terms, but when one looks at the films and television programs that have depicted the same stereotypes over and over again throughout the years, one must pause at the realization that the recurrence and perpetuation of these early images is dangerous. The visual medium is a powerful one. In fact, the rise of the membership of the Ku Klux Klan after the release of *Birth of a Nation* has been documented. Several lynchings occurred, and although there was much protest by the Blacks, the images remained to influence and reinforce racist views about this community.

Throughout the history of cinema and television in this country, the images are generally about the plights of the lead white characters, and if Black characters are included at all, they exist to serve the white characters. This reality was translated into television programs like "Beulah," where the central character was a Black maid, but the storylines revolved around her service to the family she worked for. Rarely was the story about her in any realistic, serious way.

In the early 50's, television introduced the original Black sit-com, the *Amos N Andy* series that featured a Black cast, but the characters were the same buffoons and jesters that entertained mainstream audiences for years, both on radio (played by white actors) and in the cinema. It was hardly a show that the Black community found recognizable or identifiable.

In the sixties, there were beginning to be different images of Blacks in film and television. Sidney Poitier became **the** Black film actor. In television, *Julia* was a series starring Diane Carroll as a widowed nurse, raising her son. *I Spy* featured Bill Cosby as a secret agent alongside Robert Culp. Finally, Black characters were being depicted out of the classic stereotypical roles. Instead, what then happened is that these Black characters were presented as "acceptable Negroes."

They were appropriately sterilized and sanitized and presented as those exceptional members of the African-American community who knew how to behave. These characters were primarily assimilated into mainstream screen images. They were the same as white people only with a different coloring. Where these images supported the notion of assimilation and to some degree integration, they absolutely defied the cultural distinction that existed and exists between the two groups. These images postulated that in order to be "acceptable," one had to give up one's cultural identity and conform to the standards of the dominant society.

So while there were one or two films or television programs that had Black characters, they always interacted with characters who represented mainstream society. In fact, the stories were rarely about them and other members of the Black community. Consequently, they were hardly representative of the Black community in any terms. Once again, the message defined success as one who was white, or at least as close to white as one could get: behavior, appearance, attitude, values, perspectives, etc. These same effects persist in modern-day form where African-American characters are in films and television programs that really do not reflect or represent the African-American community.

With the popularity of Melvin Van Peebles' *Sweet Sweetback's Baaaaadaaas Song* in the early 70's, we find the emergence of another kind of screen image. As a Black independent production, Van Peebles made cinematic history with this film -- both in its commercial success as well as with the controversy that ensued. Van Peebles was not the first Black independent filmmaker. Black independent filmmakers like Oscar Micheaux and Spencer Williams made and distributed films independently in the 30's and 40's. Their limited success can be attributed to segregation, where the theaters that did allow Blacks would show these films. However, they were not major commercial successes and were certainly not a part of mainstream cinema. But with *Sweetback*, Van Peebles commercially depicted a Black anti-hero who is on the run from the police. While the film is based in an aspect of reality of the African-American community, it nevertheless perpetuated some of the same stereotypes that had been criticized by that community, particularly that of depicting the Black man in the role of stud. Perhaps even more significant, it paved the way for the Blaxploitation films of the 70's.

When Hollywood saw that a film about a Black man defying the power structure, yet maintaining the stereotypes with which it (Hollywood) was comfortable, numerous films emerged. *Superfly* is a well-known example of the drug pusher, decked out in broad rim hat, sweeping coat, and platform shoes with straightened hair who eventually outwits "the man." Nevertheless, it once again glorifies the seedy, criminal injustices the Black community is not only exposed to, but confined to in terms of image, especially the nightly news. The barrage of films that followed in this era of blaxploitation almost always dealt with pimps, prostitutes, and drug dealers. In other words, they emphasized crime and violence. These images correlate with the image of the brutal savage so well established in *Birth of a Nation* -- only 60 years later.

Television also continued to rely on the perpetuation of negative stereotypes. With the advent of the sitcom, the presentation of the buffoon from early cinema was upheld, (i.e., Mantan Moorland and Stepin Fetchit's characterizations of the ignorant, yet "comical" Black man and *Amos N Andy* from early television).

Modern day buffoons included George Jefferson, Fred Sanford, and of course, Mr. Dynamite himself, J.J. from the sit-com *Good Times*. Like *Amos N Andy*, these programs had amusing moments. But when the image of a people is relegated to these flat, non-dimensional renditions, something is very, very wrong.

Even the wonderful exceptions of television history like the renowned mini-series *Roots*, which celebrated African heritage and the history of African-Americans, cannot withstand the repeated, weekly signals radiating from the airwaves that depict Black men as clowns and Black women as little of anything, except perhaps as maids as Nell Carter so aptly represented in *Gimme a Break* and now again with the new series that debuted this season, *I'll Fly Away*, about a Southern white family in the 50's and their Black maid.

When we look at contemporary images of Black Americans, it is distressing to see the same patterns sustained. On television, there are numerous programs that feature Black casts. However, nearly every single program is a sit-com. As delightful as *The Cosby Show* is, it is still a sitcom -- a comedy that entertains America every Thursday evening. Even though it has been criticized for not "being realistic," it is a relief to see African-Americans doing something else. I contend, nevertheless, that *The Cosby Show* is realistic. It is not **representative**, however, of the Black community in general, because very few Black families have parents who are lawyers **and** doctors. In fact, it is not **representative** of most groups in America. Thus it is an exception, no matter where it is placed.

I recently saw the debut of a delightful program called *Brooklyn Bridge* that is new this television season. It is warm; it is tender; it is nostalgic; it is about a Jewish family in the 50's. It has its funny moments, it has its serious moments, and I was thoroughly enjoying the program -- when I wondered. Where is the program that addresses serious human, universal topics, yet set in the cultural context of the African-American community? Where are the dramas that capture the flavor of our community in realistic, sensitive, constructive terms without being at the expense of our men -- or our women.

Where are the programs like the immensely popular, yet long-ago canceled *Frank's Place* (which now enjoys a revival on the cable channel, Black Entertainment Television)? Even when some of the sitcoms like *The Cosby Show* or *A Different World* attempt to deal with serious problems in the Black community, they are limited by their format and their time allotment.

They can only go so far, but they must always stay loyal to the fact that they are a comedy show. There is nothing wrong with having comedy shows. We all love to laugh and be entertained. But when an entire ethnic group is represented primarily by these shows, most of which portray the embedded behavior of slapstick buffoons, something is wrong. Something has been wrong for a long time.

Let us turn our attention to contemporary cinema. We are delighted by the "success" of Spike Lee. Like Melvin Van Peebles, he broke through the barrier of commercial film with a controversial, independent production: *She's Gotta Have It*. Once again, this film represented a reality of the Black community, that garnered Lee the opportunity to produce several more industry-financed films. Unfortunately, when one Black filmmaker has the chance to express his/her view, we as a general audience assume it to represent the entire group. We as an African-American audience, so starved for images that come close to portraying ourselves in identifiable contexts, want this view to satisfy all the visual needs of the community. Of course, this is impossible, and Lee's films do express a portion of the African-American community.

What could be an extremely important and meaningful outcome of the success of Lee's work is a renewed opportunity for other Black Americans to make their mark on the commercial screen. What I'm afraid has happened instead is that we are seeing a pattern repeated that was so clearly coded 20 years ago. Like the blaxploitation era, what we have today is what I call the "Homeboy Cinema." Suddenly, there is a flood of new films by a handful of Black filmmakers passing through the gate opened by Spike Lee, yet following a very prescribed formula established by the film industry about what it thinks can make money.

Once again, this bridge is one way. The images coming to us are by us, but in order to get to us must be sanctioned by a definition established by commercial cinema. An exceptional film like the powerful *Boyz N the Hood* takes a serious problem like drugs and gangs in the African-American community and presents it in a realistic way, in the full dimensionality of the community, showing a diversity of characters. Unfortunately, this film is an anomaly, and the films that follow it do not adhere to its sensitivity or seriousness.

Generally, what results is not a celebration of a group of films that represent the African-American community. Usually, what we have is a 19-year-old, boom-box wielding, faded/dreaded homeboy, bouncing up and down the street to rap music often into drugs and/or violence in fully dressed caricature. Sound familiar? You might recognize him from the nightly news as a drug dealer/gang member or from a weekly sitcom as the court jester. But I also remember him as the gangster from *Superfly* and *Shaft*. I also remember him as the buffoon from *Amos N Andy*, and I really remember him as the brutal savage from *Birth of a Nation*. The strings of these stereotypes have a way of winding themselves around current images of African-Americans, particularly young, African-American males.

As usual, African-American women don't exist except as ornaments or props in the stories of these home boys. When Charlie Burnett's feature, *To Sleep With Anger*, starring Danny Glover was released commercially, I thought: "Finally -- a film about the cultural traditions of African-Americans. A human story; a serious drama about a family in crisis." But the film was hardly promoted, and it opened in only one small theater here in Washington, D.C. for a short period of time. It has been overshadowed by the "homeboy" cinema.

Popular reviews would have us believe that these films are not only representative of the African-American community, but comprise the African-American filmmaking community as well. There are hundreds of African-American independent filmmakers. Many of them are women. In fact, Julie Dash is still seeking a commercial distributor for *Daughters of the Dust*, her first feature film that was funded by American Playhouse. The film tells the story of a Gullah family at the turn of the century, and it celebrates the rich African traditions characteristic of those sea islands off the coast of South Carolina and Georgia.

So many African-American filmmakers chose this medium for our artistic expression because of its potency and because we realize how dangerous it is for us to be misrepresented visually. We choose to use this medium to express our perspectives, to depict our community in the way that we see it, in the way that it exists in reality. Now I must be careful, because there is no one way to experience a community. Communities are diverse within themselves just as they differ from other groups. But this dimensionality has not been and still is not reflected in this society through its visualization of African-Americans.

It is precisely this lack of realistic representation, this lack of perspective that has motivated most African-American independent filmmakers like myself to provide images of our community in the way **we** know them, in the way **we** see them. It is our effort to build a lane going in the other direction to the mainland so that our true selves can be represented and the images of our community cannot be continually confined to the figments of others' imaginations. But this is not an easy task. The bricks are heavy and the technology is expensive.

I have spoken quite a bit about **perspective**. And as we well know, images reflect and establish perspective. When we only see a uni-dimensional image presented to us in but one fashion, it often does not occur to us that there can be another image or another way of looking. We begin to develop a perspective as a result of the images we have before us. We also begin to develop an understanding, a sensibility, a way of looking, a political viewpoint that is informed based on the information we have at hand.

When I was a film student at USC, I had an interesting experience with this notion of perspective. I decided to do my student film from **my** community's perspective, which, of course, was an informed perspective very different than the university's and the society's in general. I was not surprised when I received such differing reactions between the white and black communities. Actually the response in the Black community was more even, because the community understood the perspective. The white community, on the other hand, was quite varied. Many responded very angrily and negatively to this film, and many responded very favorably. As an assignment, we were required to complete a film in less than 8 minutes, use black and white film, and shoot the film without sync sound. In fact, we were required to minimize the use of dialogue. My response was a 5-minute film entitled *Justifiable Homicide.*

The film illustrates how cinema, depending on who wields the camera, reflects, influences, and sometimes alters perspective. *Justifiable Homicide* was made in 1981, long before the videotaping of the Rodney King incident in Los Angeles. The story was inspired by, although it did not attempt to represent, the case of Terrance Johnson who was convicted of manslaughter for killing a policeman in the late 1970's. Recently, Johnson was being considered for parole, and the two communities were as divided as ever on whether or not he should be released from prison. Although there was evidence of police brutality, although he was 15 when he was charged and although he has been a model prisoner, including earning a college degree, his parole was denied. However, my effort here is not to detail the Johnson case (even though my sympathies are very clear), but to show how our experiences and therefore, our perspectives vary.

Police brutality has long been a problem for the Black community. The images of young Black men, however, have continued to feed perspectives, attitudes **and** behavior. Please don't misunderstand. We have a tremendous problem with drugs and violence in our community, but not **all** Black children are guilty. If society sees Black people only in the context of 'drugs and violence, what expectations of us will society have? If this is all we see of ourselves, what self-image will we have, especially our children? What must they conclude about themselves, if they see their image limited to negative terms?

This realization motivated me to do my second and most recent film *Extra Change*, which is tame in contrast with *Justifiable Homicide*. It is a very simple film that addresses a 12-year-old girl's issues around self-esteem. The lead character has a crush on a boy in her class and goes through many extra changes to get his attention. This film is set in the context of the African-American community, in the context of a warm and nurturing family, and deals with the universal issue of coming of age. I was committed to several things in this film, but especially to celebrating the African-American cultural context as well as to presenting a feminine viewpoint.

The film shows the progress of Rita's crush on Rodney and her threat of the "fast" Jocelyn. Rita begins to take extra change out of her mother's purse so that she can buy junk food to gain weight. When she gets sick instead of getting cute, her mother discovers she has been taking the money. Rita explains that she had only been borrowing the money and intended to pay it back when she was allowed to start baby sitting. Rita learns that it is more important to focus on her personal development than to worry about the boys. When Gloria tells her that she can become a model since she's thin, Rita tells her that she is going to become a lawyer. When Gloria begins to talk about boys, Rita talks about making up the school work she's missed. The film is deliberately simple. It was inspired during my brief tenure as a junior high school teacher in Watts -- admittedly long ago.

I was always amazed that even though there were many social ills in the community, what concerned the students more than anything was "Is he/she looking at me?" an attitude so appropriate for the age group. Not all of our children are preoccupied with drugs all the time. Many of them are excellent students like Rita and have many things on their minds. Once again, we are not a group of flat, one-sided caricatures. We are human beings with the same desires, values, and goals as most other human beings on this planet.

Another intent of the film was to present the female perspective, particularly as women are pressured to conform to a certain way of appearing, as mentioned earlier. It was very important for me to raise questions about the extent to which women change themselves to be considered attractive, especially for what they think men want -- and often at the expense of developing themselves in other, more substantial ways.

Once again, I am referring to ways of seeing ourselves and ways of being seen. So much of our perspective and our direction is determined by what we see -- not only what we see of other people, but how we see ourselves. This is why it is so critical for us as African-Americans and for us as members of other groups to have accurate, substantial images. If this country is to solve its social ills, we must begin with how we see, what messages we read from the visual content of our lives. If this country is to seriously celebrate cultural diversity and have a truly pluralistic society, we must do it within the context of respect for our differences and acknowledgment of our similarities. What better way to begin than by reading appropriate, realistic images. This goal requires my lifetime work. I hope you will join with me in the context of your individual work to build bridges that truly cross cultures and that have lanes that travel in both directions.

The Making of the Johnstown Flood

Ronald E. Sutton

THE JOHNSTOWN FLOOD: SYNOPSIS

The 1989 Academy Award winning film for Documentary Short Subject made by Charles Guggenheim was entitled simply "The Johnstown Flood." It is the story of events leading up to and following the moment on May 31, 1889, when a private dam burst, sending a wall of water, sometimes 90 feet high, roaring down the Connemaugh Valley and into the city of Johnstown, Penna. Within a period of 10 minutes over 2,300 people lost their lives.

Behind the failure of the dam was the story of the Southfork Hunting and Fishing Club, an exclusive resort whose membership included some of the richest and most powerful men in America. With their summer homes dotting the shoreline, the Carneiges, the Fricks, the Mellons, and the Phipps found their man-made mountain lake a perfect recluse from the industrial noise and grime of Pittsburgh.

Warnings from the citizens of Johnstown that the club's dam was unsafe went unheeded.

On the evening of May 30, 1889, it began to rain -- the heaviest rain in over 100 years. The dam, which had been seriously compromised by the club, crested and then burst, sending a wall of water down the valley. Forty minutes later the center of Johnstown had been swept away.

Stunned by the tragedy, the nation began to question its confidence in the rich and the powerful and its growing belief that Americans were the masters of nature. (Production Publicity Sheet.)

What does looking at this film with a discerning eye tell us? First there is the honesty of Charles Guggenheim's opening title card. It says, "Many of the scenes in this film are real. Others are recreated to tell a story that was never fully captured on film." This is a clear admission and warning by the filmmaker that we are to see re-enactment and recreated scenes mixed with actuality footage.

The first images of the film are as we move down the Little Connemaugh River, or South Fork Creek, or some river or creek that stands in for the actual location; we don't really know. The filmmaker wants us to believe it is the river down which the devastating flood will roar.

There is music. There is narration. There are still photographs of Johnstown and sound effects of a city of that period. The camera is moving over the still photographs, a technique called kinestasis. It zooms in and out, pans left and right, and dissolves. We see the Cambria Company, the heart of industry in Johnstown. The cut is to moving picture images of a Bessemer blowing off molten slag in that day's most advanced steelmaking process. As the documentary flows we are led to believe it is a scene from the 1880's, but if we know our film history, it cannot be for the motion picture process was not invented until 1895! This is fakery in the service of verisimilitude, for there is little doubt from the historical record that just such Bessemers blew off regularly in the furnaces of the Cambria Works. More narration and stills of the town, its workers, leaders, and major landmarks follow. The clip-clop of horses' hoofs give texture to these images which bring the first part of the film to an end.

We now move 14 miles up the valley, swooping over a dam-like structure, then dissolving into an image of the lake at the clubhouse of the Southfork Hunting and Fishing Association. There were few pictures available to the filmmaker at the time he created the film: a few homes, one shot of the clubhouse, a shot of the lake. (More still pictures of the South Fork Club and the lake surfaced after the film was finished and a new 57 minute version was shown on PBS November 4, 1991.)

The filmmaker's skillful re-enactment begins here, with people gently rocking in their chairs on the porch, walking in the woods, boating on the lake, and working around the grounds and the dam. But if we think carefully and are not caught up in the magic spell woven by the filmmaker, we must realize this is another lake, another dam, another porch, somewhere else, standing in for the one at South Fork. Reason, logic, and research tell us that the original dam and lake are gone, the latter having run down that 14 mile valley and smashed the heart out of Johnstown.

The re-enactment here is carefully, even lovingly done, and despite what we know, we allow ourselves to be transported to this special time and place of the past in a manner similar to our experience in the narrative fiction film. We watch as the dam is repaired
in a haphazard way and some details are offered about problems with both the construction of the dam and the spillway. The famous men -- Phipps, Mellon, Carnieige -- are mentioned and their portraits displayed. Motion picture film of the railroad trains they rode from the grime of Pittsburgh to the mountain retreat at South Fork is used. Again we have to remind ourselves that the scene comes from sometime after 1895 and is used here to recreate an authentic mood and moment of the age of iron and steel horses.

We are given more information about the purchase of this property by the wealthy Pittsburgh families as well as the construction and "development" of the dam. In stock footage (a collection or library of standard, oft-used shots)

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that goes under water we are told about the fatal flaw of removing the discharge pipes. This meant that even had the Southfork Club wanted to exert responsible control over the dam and the water it contained, it would have been impossible without discharge pipes to lower the water level, both for repair and to control high water. Diagrams, shots of the dam, as well as shots of the floats and screens that were erected near the spillway to keep the stocked game fish in the lake for the rich fishermen and women are carefully shown. They were a contributing cause in the disaster that occurred, for when choked with debris they blocked what modest run off capability the spillway had. Thus ends the second part of the film.

The storm, the worst rain to hit the area in 100 years, began on May 29, 1889. Streams are shown rising rapidly at the rate of twelve inches an hour.

Those with a high I.Q. in visual and film literacy will notice here, in the shots of Johnstown proper being flooded by the rising waters of Stony Creek and the Connemaugh River, that the smoke from the mills is frozen, as it would be in a still photograph, while the water rushing by from right to left is actually moving; thus the technique of combining contemporary footage of a river at flood stage (The Potomac at Great Falls) with still photographs of the Cambria works from the 1880's in Johnstown is detected. (This was confirmed in a public presentation made by the filmmaker in March 1991, at the Air and Space Museum, Washington, D.C.) Artfully done, it enhances the drama.

The story moves now to the trains that are being held in the flood-threatened valley. Re-enactment unobtrusively presents the tapping key that sent the messages of the danger of the South Fork dam. The theme of these unheeded warnings is woven convincingly through the re-created sequences that depict the vigilant telegraph operators and the rugged trackmen. Shots of the lake, or rather some lake and spillway, follow.

At this point in the film there occurs the famous "man with lantern on dike" shot from the 1938 film by Pare Lorentz, "The River." It is one of a number of "quotations" from that film: others include the classic footage that depicts drops coming together to form rivulets, that become cutting streams, then swollen creeks and flooding rivers. Later, as the dam is seen disintegrating, shots of eroding soil from "The River" are used to suggest the power of water to destroy the dam that holds it off the valley.

Historic figures such as John G. Parke Jr., whose heroic ride into the valley to spread a warning went largely unheeded, and Colonel Elias J. Unger, whose attempts to avert disaster at the dam face were too little too late, are offered to us in careful historic recreation.

The suspense rises with the water level, the messages, the futile attempts to contain the water, until finally a stock footage image of a huge blast is used to simulate the breaking of the dam as the water explodes into the South Fork valley.

David McCullough's book "The Johnstown Flood" (1968) dramatically describes the journey of the wall of water as it swept away everything in its path. The descriptions outdo anything in the film: "Huge trees were snapped off or uprooted one after another and went plunging off in the torrent. When the flood had passed and the hollow was still again, the hill opposite the dam had been scraped bare for fifty feet up. Every bush, vine, every tree, every blade of grass, had been torn out. All that remained was bare rock and mud." (102)

Guggenheim tries to catch the spirit of this by showing stock footage of flood waters with subjective and impressionistic shots of debris in close-up under the water. The railroad viaduct five miles down stream and ten miles above Johnstown acts temporarily as a second dam, allowing the force of the flood to build to new heights of accumulated debris and water. Another blast shot again stands in for the obviously unphotographed blow-out of this second dam and the towering wall of water roars on toward Mineral Point, East Connemaugh, Franklin, and Woodvale, villages on the way down the valley to Johnstown.

The trains are menaced and the wonderfully heroic ride of engineer John Hess is depicted in recreation. His whistle tied down, and under full steam, he races backwards into East Connemaugh with the only warning the town would have that the flood was upon them.

Superimpositions of Johnstown are used again with process shots of the flooding Potomac combined with the stills to give a sense of the town being threatened. One almost subliminal shot is done through post-production TV processes showing a wall of water just before it crashes into the city. (Interview with Location Field Producer Jennifer Gruber) Closeups then follow of underwater debris and figures trapped and drowning.

The scene now shifts to the stone railroad bridge. Spared a direct hit, the bridge held and began to collect a grisly pile of trees, wooden buildings, barbed wire from a manufacturing factory, and the bodies of the living and the dead, both animal and human. Both McCullogh's account and the film indicate that as darkness fell the monstrous pile of debris at the bridge caught fire, a combination of oil from tanks and smoldering coals from kitchen house fires. As the flames engulfed the pile it became a horrible scene cremating all living things trapped in the debris. The eyewitness accounts are moving in the extreme. The source for the images of fire in the film are most likely stock footage.

A dissolve shot leads us from motion film to still images of the aftermath of the flood. Numerous photographs exist that show the damage done in ten minutes by this gigantic wall of water that tore into the city. In that brief span of time over 2200 persons were killed. Using kinestasis again, the camera reveals the photographs, moving again, left and right, up and down, and in and out. The lists of statistics are on the sound track while the camera shows the bodies, the coffins, the mud and the terrible smoking pyre that was the stone bridge.

The segue here is to the efforts of the living to gain relief. Organization is swift and immediate and courageous. The music reflects the strength of the people as money and supplies come pouring in from all over the United States and the world. The railroad viaduct upriver is rebuilt. The rains can move again. The militia protects against looters, while Clara Barton and the newly-founded Red Cross move in to curb disease and starvation. Work is started as the people restore the town.

The conclusion of the film poses some appropriate questions. Why did it happen? We move physically down the river again, then abruptly cut to a shot of the drained and deserted lake. We are told that the South Fork Club folks are gone. From McCullough we learn they ran in the night to Altoona, then to Pittsburgh, never to return. The film states it poetically:,"...a life once lived on the mountain. A life once lived in the valley." There is a final poignant shot of a dress or piece of fabric turning in the water that seems to sum up so powerfully the drowning of so much by so few.

This title card ends the film: "No member of the Southfork Fishing and Hunting Club would be found liable for the disaster. They would leave behind a broken dam and an empty lake. But also a new insight into human vulnerability; of nature's power and man's determination to survive and rebuild. Today Johnstown lives."

Thus a moving and powerful documentary ends. In my opinion it deserves its Academy Award and more. Beautifully crafted, true to the spirit of the researched history in McCullough's book, moving in its recreation of this past event, its real power is in leaving us with a hunger to know more.

To satisfy this hunger I am working on a long term branching study with the film at its center, using hypercard stacks (eventually) that will provide, on request, information about the Johnstown area, circa 1889: its geology, founding history, anthropology and sociology, its economic factors and political realities. Further information about class structure, communication devices, ecological elements related to lumbering and steelmaking that reconfigured the river valley, the media reaction both sensible and sensational, the religious fervor engendered, the racism and chauvinism expressed, and more detail about the amazing relief operation. Finally, an examination of the legal, moral and philosophical issues will be explored for those who wish to grapple with those questions. Further interviews with the filmmakers will yield an even more detailed analysis of how the film was made, with special attention to the special effects and the re-enactments.

This ambitious project will depend on the new technology of interactive video and the linkage of the computer with video disks and tapes. The extent of my response is a tribute to this film and the artistry exhibited by its author and all his assistants.

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The Ethnographic Image as Advertisement: Early Photographs in Nineteenth Century Japan

James Stanlaw

I. INTRODUCTION

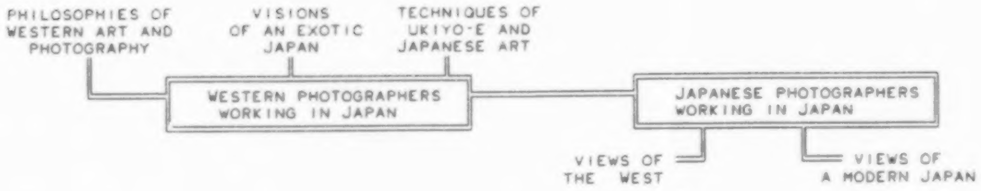
The American opening of Japan in the mid nineteenth century began a surge of cultural and economic contact that has continued unabated to this day. In the 1860's and 1870's several Western photographers (including some Japanese who were trained by Europeans) captured hundreds of images of early modern Japan. These included posed portraits of *samurai*, pictures of commoners, landscapes, and scenes of daily life.

This paper examines some of the semiotic aspects of this early photography in Japan. I explore the relationship of this new technology to traditional prints and painting and look at the cross-cultural blending of styles and forms in the visual arts. All photographs, of course, hide as much as they show, and all photographs make political statements. By attempting to capture what they thought was a "natural" Japan, with "natural" Japanese, these original craftsmen imposed a European model of technical and artistic composition. Their idiosyncratic vision of the Orient contributed to a European idealized construction of what Japan should be, rather than what Japan actually was. However, these early photographers were nonetheless influenced by the Japanese in a number of ways, especially in the use of color, patterns and lines. What resulted, then, was an intriguing visual syncretism incorporating Western views of Japan with Japanese views of the West. (This social geometry of photography in nineteenth century Japan--to be discussed in more detail later--is summarized in Figure 1, on the following page.)

II. BACKGROUND

Western photographers in Japan. The middle of the nineteenth century was certainly one of the most turbulent times in Japan's history. The Tokugawa shogunate was gradually deteriorating under the weight of a stifling economic and political structure. The *sakoku*, the 250 year period of self-imposed isolation, was coming to an end, crumbling under the weight of an outmoded and cumbersome government and new threats from the West. In 1853 Commodore Perry literally kicked open Japan's door, achieving trade concessions for the United States and establishing the first Western consulate in Shimoda. Soon after, a civil war restored the *Meiji* emperor as the symbolic and spiritual center of political power, and Japan began to modernize with a speed that still astounds modern scholars as much as it did contemporary locals. In these whirlwinds were found a number of photographers working in the newly opened port cities of Japan, in particular Tokyo and Yokohama. The two most interesting figures in the history of photography in Japan at this time were two expatriate Europeans--Felice Beato (1825-

FIGURE 1
INFLUENCES ON PHOTOGRAPHY IN MEIJI JAPAN


PHILOSOPHIES OF WESTERN ART AND PHOTOGRAPHY
VISIONS OF AN EXOTIC JAPAN
TECHNIQUES OF UKIYO-E AND JAPANESE ART
WESTERN PHOTOGRAPHERS WORKING IN JAPAN
JAPANESE PHOTOGRAPHERS WORKING IN JAPAN
VIEWS OF THE WEST
VIEWS OF A MODERN JAPAN

1890) and Raimund von Stillfried (1839-1911).

Felice Beato--also referred to as Felix by some scholars (Benjamin 1983)--made his reputation as a combat photojournalist, and was one of the four dozen or so photographers who were drawn to the Orient in the mid-1800's. After covering the fighting in the Crimea, the Indian Mutiny, and various Opium Wars in China, he arrived in Japan in 1864. He established a photography studio in Yokohama, the city with the largest foreign community in Japan at that time. He started a newspaper in partnership with Charles Wirgman, an Englishman thought to be quite knowledgeable about Japanese geography and customs (Worswick 1982). The studio was always a curiosity to the Japanese, both because of the presence of the foreign photographer and the nature of the art itself. In 1868, Beato published several photo albums, *Photographic Views of Japan*, and *Native Types*, comprised of landscapes, street scenes, and pictures of Japanese of various occupations. These photographs were very popular in Europe where a curiosity for "things Japanese" was in vogue (cf. Chamberlain 1891).

Raimund von Stillfried, another artist plagued by wanderlust, arrived in Tokyo in the 1870's. By the time von Stillfried bought out Beato's studio in 1877, after allegedly driving him out of business, some of the superstitious mystery photography had begun to fade. Even the *Meiji* emperor Mitsuhito supposedly commissioned a panoramic view of Mt. Fuji for the Imperial Palace (Edel 1986). Von Stillfried became an official instructor of photography for the government in the 1880's. His portraits of diverse Japanese, both in and out of costume, won him a large local reputation, and he carried on the tradition began by Beato of hand tinting his plates to give them a color tinge.

Early Japanese photography. Beato and von Stillfried certainly had some talented students, many of whom, such as Kusakabe Kimbei and Ogawa Isshin, went on to become exceptional artists in their own right. But Beato and von Stillfried were not the first to introduce photography in Japan. Eliphalet Brown, who accompanied the first Perry mission, made daguerreotype images, and perhaps Japanese photographers themselves may have even been working in the 1840's using equipment obtained from the Dutch at Nagasaki. The first professional Japanese studio was established by Shimooka Renjoo in the early 1860's in Yokohama, and by the end of the decade there were hundreds of photographers working in the other port cities such as Osaka as well (Worswick 1979, 1983).

The Japanese infatuation with the West. The concerted effort undertaken by the Japanese government to almost instantly modernize the country made Western items both necessary and fashionable. Foreign experts were brought in to teach at the universities, train the new army, and consult on technical affairs. Some ability in English had professional and personal import (Stanlaw 1987), and acquiring Western goods took on a prestige value beyond any practical consequence. Knowledge of the West became both the hobby and profession of many of Japan's elite and middle classes. Even the Emperor and Empress took to wearing Western clothes in public.

The Western curiosity of "Things Japanese." While the Japanese were necessarily involved with things Western, having almost been forced to adopt them by an overly-accepting government and an all-too-willing foreign commercial establishment, this contact was a two-edged sword. Westerners soon became fascinated with their new Eastern neighbors. French artists discovered Japanese *ukiyo-e* woodblock prints, and the famous American painter James Whistler, after having traveled in Europe, brought them back to the United States.

The fad known as *Japonisme*, the Western preoccupation with Japanese novelties--or *Japonaiseries*--of all kinds, was the craze throughout the late nineteenth century and through the early part of this one (Kokuritsu Seiyoo Bijitsukan 1988; Weisberg 1990). Tiffany & Co. began offering Americans a large selection of Japanese items in 1876, and the Japanese Pavilion at the Philadelphia Centennial Exhibit drew a larger crowd than any other nation's (Neumann 1963:65). The Japan Exhibition in Vienna in 1877 was also quite popular, and helped spread interest in Japan to Eastern Europe.

III. THE PHOTOGRAPHIC PARADOX OF NINETEENTH CENTURY JAPAN

Studying the early photography of Japan presents a real paradox. Simply put, why is it that much of the work done by Western photographers in Japan in the nineteenth century looks so Japanese? On the other hand, why is it that many of the pictures made by Japanese photographers at this time look so strikingly Western? These Western photographers such as Beato and von Stillfried were mature and accomplished artists who were in the prime of their careers. They would not be so easily influenced just by the mere accident of venue. Likewise, though many great early Japanese photographers were trained by Westerners, to be sure, they possessed the abilities to go beyond the mere imitation of their teacher's instructions.

I believe there are two important reasons why Western photographs have such a Japanese flavor: (1) the technical influence of *ukiyo-e* woodblock prints, and (2) a concern with an "exotic" mythological Japan that existed more in the fantasy lives of the Westerners than in any geographic locale. By the same token, there also seem to be two reasons for the apparent Western impression that Japanese photographs of this time give: (1) the prevalence of a Japanese "constructed" view of the West due to its infatuation with Western things, and (2) a belief in the ultimate success and superiority of a modern, "scientific" Japan, which made the new medium of photography take on a more practical aura.

Westerners' Photography in Japan

(1) Ukiyo-e: The Japanese influence on Westerners working in Japan. The early Western photographers were no doubt affected by the traditional style of Japanese woodblock prints which the Europeans were just discovering. There are at least three major influences that can be readily detected:

a. Color. Both Japanese and European photographers lamented the limitations of the new medium. Though many interesting and realistic pictures could be made, black and white images could hardly compare to the brilliant, almost gaudy, colorings of traditional Japanese *ukiyo-e*. Early on, Beato was introduced to several Japanese technicians who colored woodblock prints. He hired them to tint his own photographic plates, with striking results. Von Stillfried learned the craft himself from Japanese specialists, and often took to coloring his own plates. Though even the best technicians could give only an approximation of the range and depth of color of an *ukiyo-e* print, and they were certainly nothing like the modern Kodachrome images of today, Beato's and von Stillfried's photos were years ahead of their time.

b. Subject matter. The subject matter of these Westerners' photos bear an arresting similarity to the traditional *ukiyo-e* forms. Some seem to be almost outright copies, if not at least spiritual imitations, of earlier woodblock prints. These include daily outdoor scenes--messengers bringing messages, people carrying goods on poles, or women with umbrellas being blown away by the wind and the rain--as well as other more stylized and posed forms. Even similar facial expressions are often captured.

c. Composition. Formally, the structures of many of these photographic shots are also created in the same way as many of the *ukiyo-e* prints. Angles and poses of the subjects and their surroundings show similar placement. Light rays and shadows often fall in identical patterns. Some particular stances and backgrounds are found in both mediums. Settings are often the same.

d. Symmetry. One of the most conspicuous similarities between the *ukiyo-e* prints and these photographs is seen in their overall design. One of the characteristic features of Japanese art in general is configurational asymmetry. These photographs shot by Beato and von Stillfried demonstrate a noticeable lack of concern with the typical symmetry found in Western painting or photography. This is especially pronounced when viewed against other European and American photos of this time.

(2). Construction of an "exotic" Japan. These early Western photographers working in Japan in the nineteenth century were very much involved with the *Japonisme* movement. In their own way, whether intentional or not, these artists were significant contributors to it.

Another aspect of this exotic flavor is seen in what we might call the "Madame Butterfly Complex." This complex is a stereotype Western men conjure up whenever they see an Asian woman, particularly a JAPANESE woman. This myth has been continually perpetuated in popular culture, right up to the present day (as for example, with Lady Mariko in James Clavell's *Shogun,* Marlon Brando's lover Hana-ogi in *Sayonara*, Yoko Ono, and maybe even Broadway's *Miss Saigon*). Most Westerners are already quite familiar with this fantasy: The Japanese female is said to be docile and obedient, dependent and kind, and a domestic treasure. Yet at the same time she is dangerous and alluring, mysteriously sensual, and sexually adventuresome. There is also a spirituality about her that somehow cannot quite be put into words.

This myth began to be shaped in the nineteenth century by Westerners such as Pierre Loti (with his Madame Chrysanthemum) and Puccini (with his Madame Butterfly). It was natural, then, that the Western photographers working in Japan at this time, like Beato and von Stillfried, would photograph their own various Madames. For one thing, they had one occupational hazard that other Westerners did not have: studying a special style of *ukiyo-e* often referred to as *shunga*.

"Spring pictures"-- what the term *shunga* literally means--have a long history, going back at least to the early seventeenth century. With the end of the internecine civil war in the 1600's-- and, thus, the start of economic growth--the merchant classes and entertainment districts in Japanese cities expanded greatly. The rise of the pleasure quarters, the teahouse, and *Kabuki* theater were all part of the "floating world" of hedonistic pleasures and illusions (hence, the name *ukiyo-e*, "pictures from the floating world"). Many respected *ukiyo-e* artists of great renown also produced pornographic woodblocks which were as explicit as anything found currently in the United States and Europe.

Western photographers in Japan in the nineteenth century produced many photos which were similar in theme and composition to *shunga*. Von Stillfried, especially, shot many undraped women, singly or in groups, which had to be exact literal attempts at photographic imitation of certain classic *shunga* prints. No doubt these photos inflamed the European imagination, and helped Madame Butterfly become a cultural institution.

Japanese Photography in Japan

(1) Japanese Photography and Western things. It is interesting to look at the traditional paintings and *ukiyo-e* woodblock prints of Commodore Perry's arrival in Japan. The Americans are depicted with exaggerated noses, devilish facial expressions, and almost simian amounts of hair. This curiously contrasts with many photographic portraits shot by Japanese of themselves in the nineteenth century, such as those of the Chooshuu general (and future Prime Minister) Katsura Taroo or soldiers in the Sino-Japanese War. In fact, one picture of Takamori Saigo, dressed in double-breasted Western military attire, would probably be as good a likeness of the American Commodore as any early photograph of the period in either country.

Unlike the work of Beato and von Stillfried-- whose photos oftentimes have a lightness and feeling of serendipity about them--many of these Japanese pictures are serious and grim. Japanese nineteenth century photographs, especially portraiture, have a very Western appearance. Later, several of Beato's and von Stillfried's students went on to shoot abstract and nonrepresentative works, which these European photographers never did (Imai 1983).

Culture contact in general was perhaps the most critical influence. As mentioned previously, the Japanese were deeply infatuated with the West at this time. And this no doubt contributed to their particular style of photography.

(2). A modern and strong Japan. The Japanese were also quite concerned with how they appeared to Westerners. It was important for them not to look weak and indecisive in the face of this new threat, however real or imagined. To a large extent, the collapse of the shogunate government and the re-establishment of the imperial system was due to the last *Shogun's* waffling at the arrival of the Americans. Japanese photography contributed to this "Fortress Japan" mentality, especially in depicting scenes of triumphant armies, modern railways, and new Western architecture.

IV. JAPANESE AND WESTERN VISUAL LITERACY

Japanese visual aesthetics. How might we account for this Western feel found in early Japanese photographs? No doubt, these early Japanese artists were incorporating a somewhat different photographic aesthetic than Europeans. For example, even today it is typical to see Japanese comic book characters drawn with blond hair and Western facial features. These characters speak Japanese, have Japanese names and mannerisms, and are Japanese in every way save for their appearance. Readers seem rather unperturbed by this, and, in fact, seem to expect it. Long-legged skinny blond girls and tall blue-eyed wavy-haired boys are somehow felt to be more cute and appealing than more realistically drawn characters.

"Moving Pictures" in Western art. What was the attraction of the nineteenth century Western photographers to the Japanese graphic arts? The art historian Anne Hollander has argued that in the Western visual arts there has always been a group of masters that has experimented with motion. That is, there have always been particular sorts of pictures which, while even though they do not actually move, "seem to be showing a much larger section of time than the frame can contain, and seem to invite our participation in the movement of [their] potential narrative" (1989: 4). In fact, Hollander claims, certain artists like Vermeer, in the seventeenth century, anticipated the camera and the cinema.

Traditional Japanese *ukiyo-e* prints are apparently also such "motion pictures." Many European nineteenth century artists--Felix Bracquemond and Paul Gauguin to name just a few--became quite taken with these woodblocks. It is likely that the photographers Beato and von Stillfried were drawn to them for similar reasons.

V. ETHNOGRAPHIC ADVERTISEMENTS: FOR WHAT ? AND FOR WHOM?

Scholars of methodologies in visual research such as Webster (1985) and Colliers (1985) caution us never to forget to consider politics and ideologies in visual communication. There is no such thing as a neutral shot or unbiased camera angle. All photographs contain overt and covert partisan and social messages--world views and philosophies--even if the photographer was not especially cognizant of them at the time. In other words, in many ways a photograph is always a kind of advertisement, even if no ad agency is involved. What were some of the things these early photographers in nineteenth century Japan were trying to promote? Did the Western photographers working in Japan advocate a different agenda than their Japanese counterparts and students?

The "advertisements" of the Western photographers working in Japan. The visual rhetoric of the Western photographers working in the port cities offered a vision of Japan which was alien and colorful, intriguing and strange. Their Japan was the land of the *Shogun,* pristine and timeless, untouched and uncontaminated. Unlike their Japanese colleagues and students, their subject matter was not usually concerned with change, or anything at all about a modernizing Japan. If anything, when shooting these kinds of contemporary subjects--such as a Japanese customer and waiter in a Western restaurant--a subtle prejudice is found. For example, in this series of restaurant photographs just mentioned, the tuxedos worn by both customers and waiters are so big and ill-fitting as to be almost a humorous parody of all Japanese trying to wear Western clothes.

These early Western photographers carefully created their exotic Japan, concocted out of both native elements (such as technical woodblock constructions), and their own European views of what Japan should really be. Incorporated into this view were some carefully selected images of Japanese occupations and classes, as well as some chauvinistic views of women appropriated from the *ukiyo-e* "spring picture" *shunga* prints. While pandering to the Western *Japonisme* craze, these photographs did as much as anything to help create it. Considering the power of the visual image in general, and the technical skills they possessed, probably no one contributed more to this fad than Beato and von Stillfried. And no doubt some of their halftones of beautiful bathers and coquettish courtesans did much to perpetuate the Madame Chrysanthemum complex.

The "advertisements" of the Japanese Photographers. In the mid-nineteenth century, Japan was climbing out of what many felt was the "Dark Ages" of their country's history. Japan was finally joining the rest of the world and engaging in international cultural and scientific discourse. Most important, however, was a concern with how Japan appeared politically to the West. The new *Meiji* government was only too aware of the partitioning of China, the Indian colonies, and the seemingly insatiable Western thirst for Asian concessions. Their Japan--unlike the quaint and exotic Japan of Beato and von Stillfried-- had to appear modern and strong, industrialized and Westernized. At the very least, Japan needed to demonstrate competence and confidence and an ability to hold its own in the international arena of global politics.

When generals and admirals were photographed standing in Western uniforms, Japan looked like any other typical nation state of the era. When university professors wore the "high collars" of the British upper classes, it could be assumed that Japan had assimilated all the precision of Western science and scholarship. When the *Meiji* emperor posed looking like the Kaiser or Prince Albert, complete with medals and sash, the implied affinity to other European royalty could not have gone unnoticed.

However, the message was not one of simple assimilation. The real advertisement for their Japan was one of nationalism. Indeed, one of the strongest proponents of photography in Japan was the military, who carefully documented the Sino-Japanese and Russo-Japanese Wars (Japan Photographers Association 1980). Portraits of Japanese admirals and generals looked very much like their European counterparts. Shots of modern Japanese battleships and their naval victories, or the disciplined parades of the well trained and well equipped Japanese army, no doubt were impressive.

The dialectics of images. For both the Japanese and Western photographers, these various "advertisements" contained contradictions. Indeed, these oppositional relationships constitute some of the most interesting visual dialectics of the period. For the Westerners, there was a discrepancy between the real, practical Japan and the exotic, erotic, and sensual country they imaged historical Japan to be. Though Japan was infatuated with the West, the West was equally captivated by Japan. However, the fascination was merely skin deep. They were attracted to only certain aspects of Japan--the quaint and the colorful--and not the competent, or even threatening, Japan. Europeans and Americans, to be sure, still believed in the natural superiority of "The White Race" over "The Yellow Man" and were often repulsed by many Japanese habits and customs (raw fish, public bathing, Shinto and non-Christian "superstitions"). These feelings of superiority would prove detrimental fifty years later in the 1930's and 40's.

For the Japanese photographers, there were also conflicts. First, there was a discrepancy between an open, Western-loving Japan and a closed, patriotic, and nationalistic Japan. Both views could be held simultaneously. For example, portraits of Japanese generals (or even the Emperor) in Western uniform could have a Western flair. But at the same time, these were photos of JAPANESE heroes, meant as much to capture respect in the Europeans' imagination as to venerate their subjects. And Beato and von Stillfried were obviously not the only ones to have nostalgia for an Old Japan. Japanese photographers themselves could depict traditional scenes with great sensitivity as well as revering modern Japan's accomplishments.

VI. CONCLUDING REMARKS: PHOTOGRAPHY AND THEORY

The outcome of all this was syncretism. If Europeans such as Beato and von Stillfried were not working in Japan in the mid-nineteenth century, Japanese photography would undoubtedly have taken a different course. The resulting admixture produced a blending of European and Japanese technical styles, as well as an awakening consciousness in native Japanese photographers of the potential inspiration to be found in their own earlier paintings and *ukiyo-e* woodblock prints. Likewise, had it not been for these nineteenth century Yokohama photographers from Europe, it is possible that the European and American interest in Japan and the Orient would not have been as strong.

Worswick (1982:29) claims that because of these "unusually gifted and tenacious photographers ... we know exactly what Japan looked like during the final days of the shoguns." However, as romantic as this statement is, it is probably not completely true. Beato and von Stillfried did not capture an old "vanishing Japan" as much as create a new "fantasy Japan." Perhaps this new imagined-Japan never even really existed. But to Europeans, it SHOULD have, and that is even more important than any actual historical realities.

The Europeans and Americans of the late nineteenth century were cultural voyeurs. Japan had been a forbidden fruit for two and a half centuries, and this long inaccessibility made it all that much more desirable. Now, not only could you go there, but you could take pictures of it. The credibility and permanence of photography made an exotic Japan appear all that much more real.

Photography is perhaps a most appropriate vehicle for substantiating such fictions. These truths or quasi-truths can easily be authenticated through such an ambiguous, albeit compelling, medium. When we see a picture we naturally assume that "photographs can't lie," so therefore what we are seeing is real, and must be true. But photographs, like other "texts" must first be "constructed"–that is, become mentally organized by the viewer and put into a social and psychological context--in order to be interpreted. We are not mere passive receptors of images, but active readers of them as well. The author/photographer and reader/viewer must share a common language to fully appreciate the conception. Nineteenth century Europeans wanted *Japonaiseries*, an exotic Japan, and a strange and colorful people. In that sense, Beato and von Stillfried did not disappoint

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Image Manipulation: Four Points of View on the Future of "Reality"

Ann Zelle
Terry Gips
David Adamson
Charles Ossola

This paper presents four views of image manipulation from authors with four distinct points of view. Ann Zelle is on the Visual Media Faculty, School of Communication, The American University. Terry Gips is a photographic artist who helped establish the computer graphics program in the department of housing and design at the University of Maryland. David Adamson is chairman of the Computer Graphics Department of the Corcoran School of Art and Director of the David Adamson Gallery in Washington, D.C. Charles Ossola is with the Washington law firm Hunton and Williams. He is legal counsel for the American Society of Magazine Photographers, and represents photographers on questions of copyright.

ANNE ZELLE: Photographs have always been assumed to represent the real. In fact throughout the 150 year history of photography, images have been cropped, retouched, airbrushed, and melded together in the darkroom to produce composites which are far from representing "reality." Even though context, interpretation, and manipulation of images have always tempered the actual truths they represented, photographs have been used as legal and scientific proof and as documentation of reality in fields such as history, ethnography, sociology, and politics.

Two great changes in image-making have begun to erode the public confidence in photographic imagery. One is the advent of computer manipulation of images. Images can now be posterized, ghosted, pixilated, and multiplied. Images can be stretched, twisted, and "blasted." Images can be intensified, colored, colored hotter, colored cooler. Images can be seamlessly merged, deleted, cut and pasted. A computer artist or editor can feed image, text and headlines into the computer and do all editing, layout and paste-up by machine command which goes directly to the printer by disk, rather than hard copy and proof sheets.

In people-oriented service industries, clients can now make selections by a visual, rather than a verbal process. Ideas and concepts can be manipulated on a computer screen to project possible changes in everything from hairstyle to cosmetic surgery and from interior design to clothing texture and color. Initial shopping for new houses can be done on the computer in a real estate office, rather than by reading written descriptions or making time-consuming site visits. The real estate agent can access images to represent not only the appearance of a property but the way its landscape would look in different seasons.

Computer artist Nancy Burson combines a number of images to produce composite concepts. For example, she overlays the faces of nuclear-power nations to produce a composite visage entitled "Warhead I." Her process of projecting how appearance will be changed by aging is used to produce the "aged" faces of lost children we see printed on milk cartons.

The fact that images can be manipulated at will with the right hardware, software and operator for the purposes of advertising, publishing, design and composition, and just plain fun leaves open the question of whether it might be done for propaganda and other less positive motives. The recently released photographs purporting to show that missing-in-action Vietnam era prisoners are still alive may have been produced by a process similar to Burson's. We will be increasingly confronted with legal, social, and moral issues raised by the new technology:

♦ Will photography continue to be used as a basis for research in the fields of history and the sciences? ♦ Will the concept of "ownership" of images become obsolete, or will the copyright laws be expanded and enforced to protect image creators? ♦ Does SPY Magazine need the permission of the subject or of the photographer(s) to publish an image of the head of Bruce Willis sitting on the body of a male model which has been computer-manipulated to appear pregnant?

The second great change which has affected photography's claim to reality is a shift in the values and aesthetics of the art world. Scientists, artists, and tinkerers invented photography to meet the needs of a new industrial age middle class with leisure time and money and a Victorian curiosity about all things visual. The new "common man" wanted portraits, and voila! A camera to record images: real images, the way things looked.

At first, art and science were one: anyone who wanted to make photographs had to be a chemist, though not every photographer was an artist. By the end of the 19th century, photographic art and scientific photography had begun to go their separate ways, and photography was established as a separate and legitimate medium of art with its own unique aesthetics and possibilities. The 20th Century modernist artist used photography to record his/her own unique vision of reality with a clarity and detail unavailable through other media.

The postmodernist artist of the 1980's and 90's has another agenda. No longer is form allowed to stand alone without content. No longer is each work of art unique and created from scratch or from reality. Artists today appropriate and re-use images taken from every source from Classical art to contemporary advertising. Reality is constructed or created to reveal a truth; truth is no longer recorded as a round object. Today's art is not necessarily less true, nor less about truth, than earlier art. The difference is one of attitude.

For those of us in the field of education, and of visual literacy in particular, these issues are of great importance. Visual imagery today is more central than ever to the fields of information communication. Our culture is bombarded with images. Students learn to critically analyze the uses of facts and numbers. In a future which is already upon us, students must be educated to understand the use of visual imagery for statements of artistic vision and truth, for commerce, for propaganda, and for the basic vocabulary of communication.

In our mission to educate people to be visually literate, we teach the various media and techniques, the principles of design and composition, and the aesthetic principles used by graphic and visual artists to communicate ideas. We will now have the further charge of teaching literacy in computer imagery, and to that end I have organized this panel, which includes two computer artists who are also computer

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graphics teachers, and a legal expert who specializes in issues of visual imagery copyright.

TERRY GIPS: I will address this topic from two perspectives: first from the perspective of photography and its faltering reputation as a stand-in for truth, and second, from the perspective of my own artwork employing both the camera and the computer.

While there has been an avalanche of discussion in some circles recently about the photography/truth relationship, it is important to briefly remind ourselves of the origin of the prevailing presumption that a photograph is an accurate, truthful representation of a person, place, object or event. A photograph is a mechanical/chemical tracing of a real-world subject, accomplished when light reflected from the subject's surfaces passes through a focusing device and strikes a light sensitive emulsion covering a (usually flat) surface. This device was initially designed to emulate human vision, and as an aid to artists producing visual and tangible facsimiles of reality, i.e., pictures.

The preoccupation with reproducing the reality defined by vision has persisted from the camera obscura of the 17th century right through to the latest electronically "loaded" cameras that will carry us into the and millennium. Because what we see with our eyes is overwhelmingly accepted as the equivalent of reality, (in spite of practical and philosophical arguments which complicate that idea), photography in turn has been equated with reality and truth.

Thus when we see something that appears photographic but illogical such as a picture of the Mall in Washington, D.C., where a giant pencil has replaced the Washington Monument, we register a problem. A discrepancy with truth of this scale might seem trivial when viewed against the overall political landscape of the nation's capitol; nevertheless, pictures such as this are making us aware of the progressively insidious nature of photographic manipulation.

At the same time that we express alarm over the practices of manipulation, it is important to note that not only is the entire history of photographic practice peppered with examples of distortion, but also that camera artists have actively engaged and often relished the tension between fact and invention. Indeed, much of the aesthetic development of the medium has hinged on its simultaneous capability to render reality as we see it and to reveal a vision that goes beyond reality. Photographers have always "editorialized" with the camera by selective framing, timing, printing, etc. They have adapted reality to their conscious and unconscious needs, corrected imperfections, staged tableaus and events, made surreal montages of unrelated frames, and abstracted and patterns of light for purely formal or expressive purposes.

But the advent of digital image processing brings a radical change to editing because the structure of visual information is now in discrete units which can be manipulated one by one and without detection. As a cartoon of a few years ago noted, we are now digital imagemakers in an analog world, an incongruous fit. Software manufacturers have capitalized on the common human desire to "fix" things as demonstrated in ads such as the one where the Leaning Tower of Pisa has been straightened. Digital processing makes it extremely easy to make reality more pleasing. Sometimes such adjustments are of little consequence. But cases like the fusion of Oprah Winfrey's face with Anne Margret's body for a 1990 issue of TV Guide, are thought by most to be scandalous.

As has been repeatedly confirmed in my computer graphics classes, modifying a person's appearance as well as making changes in everyday objects is an ordinary desire, a routine process. Students learn in Art 101 to perform visual transformations as a way to see an object or an idea in a fresh way. With a computer, picture elements--the smallest of which are known as pixels--can be changed with incredible technical ease. This process often seems less a violation of the original image than one which involves physical cutting or erasing, and thus, psychologically becomes easier as well.

It is probably not coincidental that digital artworks often address either directly or indirectly the question of authenticity. Artist Esther Parada portrays the discrepancies of the Monroe Doctrine in a large installation work consisting of exploded and digitized media images. My own work titled Media Memory addresses the fictions that are spun by today's incessant deluge of media images. Many of us use new electronic media to decode and critique our intricate visual environment and hope that, in the process, we will prime others to do the same.

If we are to advance techno/visual literacy, we must also be aware that in addition to manipulating realty, computers are also capable of inventing reality--or at least something that is so much like reality we can't tell the difference. Virtual reality is no longer an esoteric concept of computer scientists, but rather a process of simulation with far-ranging applications. In the limited sense of a pictorial likeness, extremely realistic images can be constructed purely by mathematical algorithms with no reference or input from a real-world object.

The award winning Luxo Junior animation of mother and baby desk lamps astounded viewers a few years ago with its photorealistic quality. Software now exists which can call up images from a database; change their color, scale and sharpness; merge two or more in a seamless composite and add text and sound. Literacy in this environment requires understanding the technologies as well as the images.

In my own work, I am attempting to redirect technology, to infiltrate it with feminine/masculine concerns, to inhabit technology in such a way that it is defined by the presence of women. Computers are profound information machines and memory devices. If they are to be our 20th Century "palaces of memory," they must be guided toward enhancing people's lives'; they must not take remembering away from the human mind, and they must not separate the world of information from the world of ideas, of the spirit and nature.

I have been most intrigued with montaging two or more photographs, not in a way that hides the process, but rather lays it bare as part of the final image. A recent portfolio of cibachrome color photographs is titled The Architecture and Memory Series. A series of photomontages serves as a "memory theater" for contemplating the layers of time and space, the pathways between past, present and future. A veneer of digital grids is used intentionally in these images as a foil for the subject matter: archetypal buildings and figures which are meant to be both transient and timeless. Sometimes the building and the figure seem to occupy the same space, the body becoming the house, the wall becoming the transparent membrane of the psyche.

While the images do not direct us toward a specific relationship with technology, the various Greek columns, spiraling interiors, and vernacular facades allude to the culture that we have constructed over time. The pictures invite each of us to spin our private memories and dreams across their surfaces; but they also remind us that technology increasingly blurs the personal and the societal, and that only by actively engaging technology can we affect its course in the future.

DAVID ADAMSON: As an artist, and as a gallery owner, one of my main concerns, is how to take this electronic digital image and make it real, and make it saleable. That might sound like a crude concept to begin with, but in fact it has been instrumental in preventing computer art from moving into the mainstream of art, into the established gallery situation. Galleries rely on sales and will not show art that can't be sold.

My earliest computer work is about seven years old. It was done on a little Atari home computer, which would display a maximum of 32 colors, at very low resolution. The image was appropriated out of a magazine. Actually, it was traced and then digitized into the computer and the colors were altered. The eyes and the lips were moved around in a very primitive manner. It was all that was available to us at that time.

One of the issues I've been involved with, is finding an archival manner of producing computer art, of a scale that is imposing. Artists should be free to choose any scale they want, without combining small units of information together, which was the way I began increasing scale. I took six cibachrome (color) photographs of the screen and just dry-mounted them together to get a big piece of art. You can very easily see the pixelization and the shallow depth of color. It's probably falling apart now. It's probably changed color. Cibachrome isn't really permanent, so that was obviously a bad solution at that point.

We had a major breakthrough in terms of computer imagery when the Macintosh first arrived on the scene. It was the first sort of intuitive, easy-to-use machine, that artists could understand from day one. So I started using the Macintosh to generate larger works.

When you scale an image up, you also scale the pixel up, so you're left with a very definite computerized look. Also the paper was non-archival, so although the inks are carbon based inks and are very permanent, it still had archival problems.

The sophisticated color systems really started to come down in price about three years ago. All of these new color systems are basically market driven. They are not designed for artists. They're designed for the high end of the industry, for the printing trades, for magazines and advertising. Just about every printed image you look at today, regardless of whether it has been altered in any way, is produced through a computer. Almost every magazine cover is scanned in and produced from a Scitex; color is altered to balance the color plates, even if the image is not altered.

I began to work with live video framegraphs. A video camera was hooked directly into my computer and took the portrait of a little girl. Then very subtle changes were made, little blemishes were taken out, a different background was dropped in, and the color was enhanced very subtly. This was done on a software board that you fit in your Macintosh. It has sixteen million colors instead of the 256 of earlier systems. The artist has the ability to alter each single pixel.

So finally we've reached a state of computer art where the color doesn't matter, the resolution doesn't matter; you're working with a tool that can approximate an artist's visualization. That still led me into deeper research on how to make these things real. So I hooked up with a company in California that was using computers to generate billboards on a very large scale, 20 by 40 feet, and persuaded them to take some of my images and paint them on canvas using acrylic with their billboard machine.

The system uses a gigantic ink jet printer that you can load with acrylic paints. When I say gigantic, it's the size of a large room. The painting's support, or substrate is wrapped around a giant drum and then, under computer control, each of the ink guns is fired. The spray dot would approximate a pixel dot, or a dot on the screen.

In another group of portraits, I fed a live video framegraph to record an image into the computer. Two children, a four year old and a seven year old, would not keep still for the photograph, a common problem with kids. There is a greater problem when you work with video framegraph, because it is very slow and takes a thirtieth of a second, so any movement results in a blur. The children were all over the place, but I did manage to get an acceptable photograph of each of them and then cloned the two images together.

Then to drop out the original backgrounds, I picked up a color from the lips of the children and from a shadow from under the neck of one of the children, and plotted a background blend using those two colors to get a very nice homogenous translation of the image. This painting was then printed out 10 feet X 8 feet and happily sits behind the parent's desk in his office at a law firm in town.

However, you still have problems with this particular process in that it creates a rather diffuse image. It sprays out the image and is only useable for images of a giant scale. I think 4 X 5 feet is really as small as you could go, and you get a very soft kind of impressionistic, diffuse look. So I've been working further with that technology, and basically reinvented this printer. Instead of using the little jets to spray out the color, it uses a hypodermic syringe, the smallest one you can get on the medical market. The resulting image is much sharper and more detailed.

The ink that we use is oil-based ink, and we can use any substrate, a gesso canvas or a watercolor paper, to produce an extremely dense, high resolution image from the computer. Computer created oil on canvas paintings open up a whole new range of questions of appropriation, and copyright, and creditability. Now we could take the Mona Lisa image, recreate it in oil on canvas, varnish it, and have something that would fool 90% of the population.

CHARLES OSSOLA: It's appropriate that I go last, because the law is behind in trying to deal with the questions about the protectability of these kinds of images. Federal copyright law deals with questions of protecting images, licensing images and what constitutes an infringement of images. That is obviously an everyday problem, given the technological developments of computer imagery.

Federal copyright law protects works of art, virtually anything that is fixed in any tangible form, from the moment it is created, and it gives very substantial rights to the creator, especially in terms of control of reproduction of the work. The new technology and computer graphics raise legal questions about the exclusive right to control the production of derivative works.

Virtually all of the work of computer artists constitute derivative works under the copyright law. The right to create derivative works is the exclusive right of the copyright owner of the original image. Now that sounds relatively simple, but technological changes are making this work with great difficulty.

First of all, copyright owners face the problem of detecting infringement. How do you know that your work has been used, and how do you find the infringers? Second of all, you have the question of how do you prove infringement: if the work was digitized originally, it was manipulated, and what finally emerges may not really look very much like the original work. Copyright law has traditionally relied on a very subjective test of substantial similarity, which is a jury question, an eyeball question, generally.

These kinds of issues are just starting to come into the courts now. How do you decide whether a computerized image was manipulated, without permission of the copyright owner, the person who owned the rights to the original image? How do you tell if that subsequent image is an infringement, when it doesn't look very much like the original image. Is that an infringement or isn't it, even if the basis for the second artist's work was in fact the original image? You also have the question of the practicality of infringement remedies. The remedies available to the copyright owner in infringement are very broad and powerful, but how do you deal with the problem of many, many infringers... first of all finding the infringers, then dealing with the infringers?

I'll give you one example. I represented a very well-known science fiction illustrator, whose image was on the cover of a science fiction book. It was taken by somebody without his permission, put on a computer network, and downloaded all across the country. Of course it was virtually impossible to find out who the users were and what they had done with the image. So we proceeded with an infringement action against the computer company that owned the network. That was an example of going for the known player when it's impossible to go after all of the little players. That's one possible solution here, a course which is of great concern to computer companies, producers of CD-ROMs, and people who operate computer networks.

Questions of liability that arise in the context of what I just described are very difficult ones. You also have the question of the expense of going after infringers. How is that going to be feasible, even if the remedies are powerful? How do you go after these people even once you find them?

The other issue that is assuming increasing importance in the technological era is the question of joint copyright intersect. By that I mean a work that is the product of more than one person's creative contribution. Under copyright law that means it is a joint work in which each party shares equally the rights in the work. Even though one has created a very small quantitative portion of the work and the other the majority of the work, they are both joint authors of the work.

In the context of computerization, when many people may be working together, how do you determine who the joint authors are? In the advertising setting where a lot of disputes arise, you have claims, for example, that the original photographer is the original author and the copyright owner; the art director's saying "Wait a minute, I had a role in this", then you have the people on staff at the advertising agency who say "Wait a minute, we did computer enhancement, we did some colorization, we're also joint authors"; and then the ultimate client, such as Reebok, had some technical people involved, and they may have manipulated one part of the image or another. Everybody is claiming rights to the final product and, under the copyright law,

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if all of those things happened, then all of them can claim a copyright interest in the final product.

If the final product is valuable, and all of those people have an authorized distribution of the work, then you have all of these people knocking on your door claiming a share of the profits associated with the exploitation of that image. It's an immense liability problem, and it also poses some really complex problems of contract law and how you deal with all of these participants in the process.

Let me give you a few examples of disputes in which these issues are being raised. One that was in an article in the New York Times involves an artist by the name of Jeffrey Koons who used a copyrighted photograph as a basis for producing a sculpture, and was then successfully sued by the photographer for copyright infringement: the photography was taken and virtually recreated by another artist in sculptural form. The question was, if it's in a different medium, is it an infringement? That was, in my mind, a fairly easy case. Yes, it was. The case is now on appeal, but it raises some interesting questions of what artists can do with copyrighted work.

In virtually every creative endeavor the process of creativity is an evolution, and everybody is building to some extent on other people's prior work. Copyright law permits you to do that as long as you take the idea from someone else and put it in your own words or manner of expression. Copyright law does not let you take that expression of somebody else and use it, manipulate it, for your own purposes.

Computer artists are often taking pre-existing expression and manipulating it, changing the number of images, or the arrangement of images. If the underlying image was a copyrighted image, and if that was done without permission of the copyright owner, these may be copyright infringements. Often times people say "Who cares, these are so commonplace that it's virtually impossible to deal with this." But the copyright law is struggling to do so. If you're the owner of the underlying image, then you may view this differently than if you're the manipulator of someone else's image. So you have artists and creators on both sides of this issue, both wanting to protect the integrity of their works and also wanting to be able to use other works, to create very different things.

Congress has tentatively tried to come to grips with this in a very limited way in a recent amendment to the copyright laws called the Visual Artists Rights Act of 1990. Congress, for the first time, put into the copyright law the concept of moral rights of creators. Moral rights are the rights to protect the integrity of a work, for a certain very limited category of works: paintings, drawings, sculpture, a limited class of photography, basically still photographic images created for exhibition purposes.

For those works there are two very interesting rights that are brand new to American law and just beginning to feel their way into courts. One of these is the right to attribution, which is your right to claim authorship of a work, and to prevent your name from being used with an altered image. The second is the right of integrity, which is to protect a work from defacement, mutilation, and arguably manipulation.

Whether computer manipulation can constitute a defacement or some other kind of mutilation of a work under the language of the law remains to be seen. This is a very new, very tentative venture into this area, and it indicates how belatedly this body of law, and the courts and juries are beginning to struggle with these issues. ■

Visualizations of a Silent Voice: A Deaf Poet's View

Curtis Robbins

Often, when I go walking,
And the dialogue resumes, the
Interior gossip which has been
Going on since identity,

I've wish to put in a poem
Those illuminations, percepts
-- What percepts!

The verisimilitude of this prologue which is from the poem, "Words," by David Wright (1988) prompted me to begin the session with a poem I wrote last year, "Phantasmal Voices."

Voices aren't heard.
Not even seen
or imagined.
And certainly not,
hallucinated --
not out of nothingness.

Voices are not placed
like Rap with a Chinese face,
or barking by an airplane,
or an F sound in the letter Y,
or a cooing by a lion,
or hand-signing
by a wind-swinging tree,
or ghostly booings from a pussy cat,
or even, a high C tenor
by a rock-and-rolling lady.

Voices are not
God's word.
Not that of Satan
or the dead.

Voices are
lost hands --
malapropos lips
snug on the faceless.

Voices are displaced,
replaced,
implicated,
immunized --
warded off
by graphic
depictions.

Voices,
realized (by the virtue
of our senses),
are phantomized
by synchronized
voices.

It was written to debunk Oliver Sacks' ambiguous notion in his recent book, **Seeing Voices** (1990), which states that:

It is difficult for us, as speaker-hearers, even to conceive such a visual "voice," as it is for those who never heard to conceive an auditory voice. (p. 6)

I was tempted to write more about phantasmal voices in this paper. Instead, I decided that it would be better to explain from the artistic point of view what these visualizations are all about. Indeed, phantasmal voices are visualizations. The definition of visualization I believe is best found in Samuels and Samuels' book, **Seeing With the Mind's Eye** (1975). What they stated clearly points out just how poetry comes to being:

As language developed words came to serve not only to evoke images or experiences but to enable the speaker to

> *establish distance between himself and his experience, to separate himself from the experience and externalize it.* (p. 17)

In addition, this paper is about poetry by deaf persons who write poems phenomenologically as poetics dawdling phrenologically for meaning, and as romantics dabbling in dreams. Also, this paper reflects these visualizations by another group of deaf poets whose work is theatrically and artistically performed primarily in sign language -- which may or may not have been written prior. Quintessentially, whether we are writing or signing, we are obsessed with language. Here, Wright, a twentieth-century British deaf poet, in his autobiography, **Deafness** (1969), concurs by explaining why he chose to be a poet:

> *It has...been my luck to be...a poet. A* ***sine qua non*** *of the vocation is obsession with language and words....I cannot tell whether deafness has damaged my poetry, but I know that poetry has damaged my deafness. Because words and language are its medium they are my predilection.* (p. 103)

For the most part, visualizations are happenstances experienced or generated by conceptual frameworks, actual situations, or both, as a reference point to that poetic design. To describe them with a flair for choice words and language becomes an enormous challenge. This, I should add, is not the same challenge you'd hear about from just any poet. And so, we are here to find out how a deaf poet's engineering of language draws conclusive visualizations. Keep in mind that the language of poetry is never all-conclusive, which is, always, always left for the reader to determine. Not that poetry is written to hide itself but to perpetuate its definitive purpose.

Again, I must stress that we are talking about the deaf poet. We often hear that deafness is considered a communicative disability rather than a physical one. This is a noisy world -- hearing people listen to it. The silence that it imbues is never absorbed. Rather, it is shunned because it is different from what hearing people are accustomed to. For them it is terribly handicapping. Deafness is not, of course, something that copes with silence. Instead, deafness deals with it. Therefore, noise is a handicapping factor because it is difficult to cope with. Sound, on the other hand, is perceived by everyone. Noise is sound. So is silence. Sound emulates the presence of being in any situation. Sound is a conundrum, it can be anything -- as long as somebody's there to tell about it, or create it. Wright went further in saying:

> *My habit has always been...to listen to a noise a poem makes before beginning to attend to what it is actually saying or projecting. The auditory rather than the visual captures my imagination in the first place. I daresay it shouldn't.* (p. 75)

Now, poetry has always been conceived as the artist's mastery of language which appeals to the listener from the voice of the actor, or from the "mind's ear" (p. 86) as Falberg (1968) would say. Poetry, in its dignified form, is a grouping of words shaping images by describing images explicitly; if not implicitly -- the visual impact of sources induced by sound. This may explain the failure of deaf poets to reach the higher echelons of the literary circles. Generally, poets must establish their credentials by performing readings at literary circles, publishing selected poems in various periodicals and anthologies, and finally, publishing their own books -- such as artists establishing their reputations through gallery shows. It's a cultural conundrum within our own society. Words of deaf poets are hardly heard. They're hardly spoken -- not because they can't say it -- but because the language is unspeakable. They cannot even be signed because they already have been destined to specific designs. In other words, when interpreters vocalize what deaf poets sign, everything is metaphrased in different tangents. Otherwise, if taken to theatric signing, deaf poets would only re-interpret the original meaning or intent. So, what are deaf poets to do? How are you to determine who the deaf poets are? Thus, the conundrums.

At this point, I want to take the time to talk about this David Wright, once again. Ever a classicist, he, perhaps through no fault of his own, schooled at Oxford, wrote poetry in a very stylized matter. He became deaf from scarlet fever at the age of seven. He has published several books of poetry and edited several major anthologies of English verses, a number of them published by Penguin Books. Here is one of his poems, taken from one of his books, *To the Gods the Shades* (1976), called, "A Funeral Oration" (p. 31).

Composed at thirty, my funeral oration: Here lies
David John Murray Wright, 6' 2", myopic blue eyes;
Hair grey (very distinguished looking, so I am told);
Shabbily dressed as a rule; susceptible to cold;
Acquainted with what are known as the normal vices;
Perpetually short of cash; useless in a crisis;
Preferring cats, hated dogs; drank (when he could) too much;
Was deaf as a tombstone; and extremely hard to touch.
Academic achievements: B.A., Oxon (2nd class);
Poetic: the publication of one volume of verse,
Which in his thirtieth year attained him no fame at all
Except among intractable poets, and a small
Lunatic fringe congregating in Soho pubs.
He could roll himself cigarettes from discarded stubs,
Assume the first position of Yoga; sail, row, swim;
And though deaf, in church appear to joining in a hymn.
Often arrested for being without a permit,
Starved on his talents as much as he dined on his wit,
Born in a dominion to which he hoped not to go back
Since predisposed to imagine white possibly black:
His life,like his times, was appalling; his conduct odd;
He hoped to write one good line; died believing in God.

Let me go further, Fussell (1979), in his classic text, *Poetic Meter and Poetic Form*, laid claim that

> *Meter is what results when the natural rhythmical movements of colloquial speech are heightened, organized, and regulated so that pattern -- which means repetition --* ***emerges from the relative phonetic haphazard of ordinary utterance.*** (pp. 4-5) [emphasis added]

This epitomizes what poetry criticisms are often written about -- emulating sound-oriented phenomena alluded to rhyme, alliteration, assonance, tone, onomatopoeia, syllable, tension, timbre, foot, and so on. For, they are tools that conjugate "the *formation* of sounds by the mouth and *recognition* of sounds by the ear" [italics by author] (Collins, 1970) (p. 113). In essence, "diction determined more by acoustic values than by semantic exigencies" (Hamburger, 1982) (p. 21).

On the other hand, visual poetry emphasizes imagery, metaphors, similes and the like. This involves a different kind of wordplaying just like looking for the right brush for a certain texture or stroke, or the right chisel for a certain cut, or the right herb for a certain taste. The word must project, interject or cascade the intent. The metamorphosis of a poem by lingering visualizations is greatly labored in the process. While diligently manipulating a cadence, the poet constantly asks in every phase of the craft: is this poem canvassing the picture -- by such choice of words -- of the desired image? As a deaf poet, I cannot "play by ear " I cannot allow or follow poetic conventions. I have decided a long time ago that the sound of my visualizations must be seen. I must let instincts play -- I want my readers to see what I see. I have an assumption that all my readers are hearing. Therefore, I must determine the final outcome by asking three elemental questions: Will they hear my silence? Will they see my voice? Am I in that image of which I believe I am?

Significantly -- and ultimately, this is a **wonderful** fear for a deaf poet in order to reach his readership. There are terribly frightful rules in every poetry textbook, whether for appreciation, or for the art and science of it, which always shudder my bones, and constantly reverberate in my mind every time I sit down and compose. It is stated aptly by a twentieth century British poet, Philip D. Roberts (1987): **"the poem...fails to interest and attract the ear"** (p. 9). How can I? Why should I? I am not, by nature, here to appease the ear -- yours or mine! I am a product of a different culture which has been molded by what we call "hearing culture." We are influenced by sound -- yet we have never been fully able to deal with it or cope with it. And so, we are, by and large, much more visually literate. Poetry, then, in spite of the fact that deafness is a communicative dysfunction which also affects the spoken and written language, becomes our challenge -- not to master language but the art of it. Let me illustrate all of this with another poem I wrote called "Cataclysmic Energy."

Libidinous conception --
a cold burning.
My mind's
trembling hands,
writhing face,
drying mouth,
squirming body --
sweat beads dripping --
drip,
drip,
drip --
beating.
Beat,
beat,
beat,
dripping --
beating
a quiet drum --
a quiet brush;
beating
a quiet shofar --
a quiet pen;
beating
quiet strings --
dripping into my quiet soul --
creation.

Right now, there are two movements of deaf poetry. One follows those who espouse the traditional written form, where classical and contemporary poetry writing is paramount. Here deaf poets emulate their visualities through spoken and written language. **Whether they sign or not is immaterial** -- it is how they execute the art. They write it as they sense it. Wright (1969) spoke of "phantasmal voices" (p. 22) when he began to realize the significance of his hearing loss. These voices were illusions of seeing or feeling sounds as they occur perhaps as a form of compensation. Such is a phenomenon that perhaps exorcises such power to create these visualizations into poetic form.

The second carries the torch for a much older movement, the oral tradition (or performance poetry), called "ASL Poetry." Here, the poetry is expressed through artistic signing with significant facial and other body movements; thus, maintaining its original meaning. Bear in mind, as one of the prime movers of ASL Poetry, Clayton Valli (1987), said, "ASL poetry is videotaped and performed by a number of poets, but there is no definition of the nature of poetry" (p. 174). ASL poetry is not always written beforehand, rather it is performed timelessly until perfected. For instance, Patrick Graybill, a well-known American deaf actor and poet, would sign a poem, write down the words, and continue to find ways to improve the visuality of the poem through his signing (September 29th, 1991). Though, for the most part, ASL poetry is subject to written interpretation. The bottom line, henceforth, is that signing is a medium of expression just as writing is, but for ASL poets, writing poetry does not do justice enough to convey their visualizations.

When performing ASL poetry, there are poetic constraints established to acclimatize the new literary movement. At this moment, in Rochester, New York, the National Conference on ASL Literature is convening. There are two main purposes, among others, for this milestone: one, to discuss the current state of the art in Deaf poetry and ASL poetry. And secondly, to standardize the poetics of ASL poetry based on handsigns used, balance of hands, flow of movement, transformations in signing, speed of execution, facial expressions, position of body, use of signing space, along with the other elements in poetry such as rhyme, rhythm, metaphors, symbols, etc. As Valli (1987) points out,

> *For sign language the eye has the power to identify the movement of visual signals. Visual movement depends on body movement which has structured, sequential components. Such components are each composed of a number of parts.* (p. 175)

ASL Poetry, though, in itself relatively new, is also a form of folklore. Every time the poet repeats the tale, the signed poem improves. They are stories of the deaf Everyman. These tales, believe it or not, carry the same story lines in different sign vernaculars by different deaf poets from the world over. Just like the story of Allanadale, who strummed his mandolin along the ways to gather his keeps, singing tales of legendary Robin Hood. As he sings at the different villages, he adds or modifies a verse or two as he listens to village gossip -- just so to improve the melody of the ballad, and update the news about his folkhero. And of course, as a merryman himself, he kept Robin Hood informed. Who knows, perhaps, this may have been oral history of early England as the source for the legend written in the fourteenth century just when the printing press was about to be first introduced.

I want to show you a videotape of Pat Graybill's poem which exemplifies what I've been trying to say. Here he expresses his concern that in all the years spent in the schools or programs for the deaf, the primary focus of education was always on the regimentation of language development and the rudiments of speech in order that we be able to function in the hearing society when departing from the academia. But, there are those frustrations and consternation that they entail. Pat went much further to say that as a deaf person reaching a certain point in time where compromises are made by recognizing and accepting each others' communicative modes; thus, his liberation. The poem, "Liberation," is a beautiful, definitive rendition of this classic feeling. Before I go on, read the overhead transparency of his poem in written form. Pat mentioned to me in his letter of September 29th, 1991 that the poem was "originally created in ASL before being translated into English" (Graybill, 1991).

English, English!
Thump, it is pounding!
It even suppresses me.
For me, ASL is the way,
but my hands are chained together,
causing me to simmer, boil and erupt.
ASL liberates me,
I confront English,
struggle with the oppressor
until we have terms of agreement,
shake hands with each other.
Peace! Curtain call!

His typifies other ASL poetry. Again, minute tales of deaf Everyman in every ASL poet. They are not to be read, but seen.

In fact, it is important to recognize that the marketing intent of the producer of the ASL Poetry Videotape Series, Silent Media, Inc., is that they are primarily targeting these tapes for the deaf audience; thus, no voice-overs or captions for those who have little or no knowledge of American Sign Language or ASL. In the final analysis, I am rather skeptical of the scholiatic fortitudes as oral history on laser or magnetic media, or film. They tend to be technologically outmoded in a very short span of time.

Moreover, there are artistic overtures of ASL poetry. I have another beautiful poem performed by Valli called "Dandelion" on videotape. Interestingly enough, the beauty of this poem is how each hand, facial expression, and body movement work together to transform its overall visual meaning harmoniously. This is what John Ciardi (1975), in his acclaimed text, **How Does A Poem Mean**, was referring to when he says:

> *The act of producing a word involves breath and muscle, and various kinds of muscular activity tend to produce various kinds of feeling. Thus, aside from all other considerations, **the bodily involvement in sounding the word is the distinct part of the word personality.*** [emphasis added] (p. 103)

Watch Clay's signs carefully because they are representative of familiar things and situations on the lawn. Watch his handshapes, they are motifs of a dramatic moment. And, watch his lips, they're imitating sound, too! They are, synergetically, actions that speak for themselves -- like a motion picture of an actual minute event. I also have here a transliteration and translation of Clay's poem by Ceil Lucas on the overhead transparency. Look at the language carefully.

A vast blanket of yellow flowers gently waving,
pleased, satisfied, unsuspecting.
A strange man appears suddenly
and in their fright,
the yellow flowers cease their waving.
The man glares and yells
"D-A-N-D-E-L-I-O-N-S!"
Viciously he pulls at them
and mows until there is nothing but grass,
an even green expanse.
Rain, rain, and more rain.
The rain disappears, replaced by the sun,
and from the light, wet, tender soil
comes to seedling,
growing tall and blissfully flourishing.
Bud bursts open to release yellow flower.
Bee zooms to them,
greeting and sharing.
The bee flies away.
Slowly closing, the flower sleeps
all night and all morning,
awakens, slowly closes, sleeps
all night all morning, bursts open...
round puffs now, soft and white.
The waving begins
as the seedlings drift off and catch the air,
one by one floating
with the wind, unsuspecting.
The man appears suddenly
and with a disgusted expression, yells
"T-H-E-R-E!"
The brave puff waves and waves
as the man grabs it and violently tears it off,
scattering seedlings every which way.

Indeed, there are noticeable differences in the conveyance. There is never justice in

Rolling Waves riding kneading Tides!
Kneading Tides!
Kneading Tides!
Higher and higher.
Harder and harder.

Gushing the Shores.
Gushing the Dunes.
Gushing the Rocks --
rapping at my door.
Rapping at my door --
running from the storm
reaping the sea.

Rising Swells riding kneading Tides!

Roaring Waves!
Surging Waves!
Rushing Waves
running from the storm
reaping the sea.

Rising Swells!
Rising Waves
rapping at my door.
Rapping with the Devil
at my door.
Devil at my door --
running from the storm
reaping the sea.

Rolling Waves riding
kneading Tides!
Kneading Tides!

Rolling Waves riding
kneading Tides --
higher and higher.
Harder and harder --
rapping at my door.
Rapping at my door.
Rapping with Death
at my door.
Death at my door.

Running from the storm
reaping the sea.

Rising Swells riding kneading Tides --
rolling Waves riding kneading Tides.
Kneading Tides!
Kneading Tides!

Running from the storm
reaping the sea.

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the written form because its true meaning is lost in the transliteration and/or translation (depending upon the signs or movements). Even poetic license would lose itself in the poem if there is any attempt to describe the action -- aside from the signs, movements and expressions performed. Clearly, ASL poetry justifies the inadequacies of the written form.

Finally, it is important to look at the textbook anomalies of poetics once again, in order to recognize the significant differences between hearing and deaf poets. Is there justification to satisfy the "ear?" Picture in your mind the microcosm in a macrocosm. In terms of the written and spoken word, deaf poets are forced to deal with the poetic particulars. Deaf poets -- due to peculiar responses from strange stimuli -- would expedite harsh criticism from hearing poets due to such unintended yet gross misunderstandings. Deaf poetry may never reach the echelons of the finer elements of the written and spoken language. That's not at all our fear, it is expected. There has to be a form of compensation for our particular kind of sensory loss. These peculiarities are therefore "normal" by deaf cultural standards. Consequently, there is an underlying mission for all of us deaf poets which I believe my poem, "My Hands Or My Voice," reflects:

I speak.
I sign.
I speak.
I sign.
My hands or my voice?
Who will hear me?
My rage.
My song.
My rage.
My song.
My hands or my voice?
What will it be?
My song.
My rage.
My song.
My rage.
My hands or my voice?
Who will sing with me?
I sign.
I speak.
I sign.
I speak.
My hands or my voice?
Who will silence me?

I'd like to end the session by reading one more poem that I also wrote. I want you to know that it has been rejected by several poetry magazines -- which is par in this life. In fact, when I first read it to the members of a local poetry group that I go to, they were criticizing the poem relentlessly without recognizing my frustrations -- I couldn't follow the flow of the critiques. Though a crucial stage of the art, but because of the communication difficulties, I may never be able to catch up with the poetic jargon, socially and otherwise, in order to improve my work over time. By the virtue of high membership attendance, unavailable sign language interpreters, poor seating arrangements and poor lighting especially for lipreading purposes, and above all, the condescending camaraderie in their own elite circles, they politely ignore me. In essence, as a deaf poet, I stand alone in the literary world -- of which I want very much to be a part of.

This poem will tell about this anger. It is called, "Death and the Devil At My Door." Listen to its visuality.

> *Alone, alone, all, all alone*
> *Alone on a wide, wide sea!*
> *And never a saint took pity on*
> *My soul in agony!*
>
> "The Rime of the Ancient Mariner,"
> Samuel Coleridge

Running from the storm
reaping the sea.

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East Moves West: Questioning the Verbal Supremacy of Traditional Literary Studies: The Visual/Verbal Interaction in Salman Rushdie's The Satanic Verses

Terri G. Pullen

In his work, *Visual Thinking*, Rudolf Arnheim (1969) very adeptly points out the keen, necessary relationship between the visual and verbal areas of perception: "Language turns out to be a perceptual medium of sounds or signs which, by itself, can give shape to very few elements of thought. For the rest it has to refer to imagery in some other medium. Obviously, this must hold true for all the parts of verbal statements, not just for some; they all need a mental realm to exist in" (p. 240). What is key to Arnheim's assertion is that language does in no way supplant the visual base of perception; instead, language serves as an organizing device that invites conceptual links and imposes complications on the cognitive connections to be made from verbal cues.

To understand this delicate, cooperative balance is to understand the crux of the visual/verbal relationship in a more refined way than privileging either the verbal or visual has done in the past. In short, to understand this relationship is to begin to understand the roles of all perception as a part of cognition itself. Failure to recognize this intense dynamic is to fall into dangerous traditions, and as Arnheim points outs, "A perceiver and thinker whose concepts are limited to the kind foreseen by traditional logic is in danger of performing in a world of paralyzed constructs" (p. 46).

Unfortunately, all disciplines have their dangerous, exclusionary assumptions that serve to thwart interdisciplinary connections, assumptions that aid reductive thinking about human perception and cognition as manifested in the objects of study within that particular field. For example, some members of the visual and verbal camps have squared off, treating the each as the "other" or the "opposition," creating a false dichotomy that stymies true integration and cross-disciplinary communication. What is more, these reductive assumptions exist within fields as well and often quite unintentionally. For example, Salman Rushdie has been given the language tag of novelist, and is therefore seen as having allegiances to language over images, when by his own admission, this is not true at all. When asked in an interview why he wrote novels, Rushdie replied that it was something he could do by himself, sitting in a room, but added, "I'd love to make a movie. If you gave me a film to direct, I'd never write a novel again" (Greenwood, 1991). Rushdie also stated that books were not his primary influence and did not exclusively inform his thinking about his work:

> The thing that really made me think about art in a serious way was the new wave cinema. . . it was very exciting to be going to the cinema at that time, and

> certainly I wasn't getting similar kinds of excitement from books. I mean it was movies and music and theater in that little dawn of '65-8. . . My education came from cinema more than anything else. (Greenwood, 1991)

In light of such statements, banishing Rushdie to the verbal realm alone is to ignore the role of visual perception as one of the precursors to his work as a novelist, and thereby to ignore the work of someone who recognizes in practice what Arnheim speaks of in theory. Yes, *The Satanic Verses* can be discussed as a novel with the traditional attention paid to imagery and symbolism, but to discuss the work only on this level leaves out the perceptual base of cognition that takes place before the act of writing. To stop here is to fail to question what Rushdie experienced visually, and thus cognitively, that led to his using language referents for visual perceptions, perceptions he assumes have taken place in the readers of his works. In addition to the book experience of the text, Rushdie assumes certain visual experiences of his readers, and in order for a more complete understanding between reader and writer to take place, the preceding visual experience must be shared. Consequently, the acts of writing and reading then ultimately operate on the principle of am anamnesis, or memory, the act of recalling to mind. The words Rushdie uses are merely road signs that direct readers to recall visual experiences and to connect these conceptual images according to the context of the novel, creating a synergetic relationship between the words of the book and the images as external referents. These words are not substitutes for the visual perceptual experience; they exist as a part of a complex cognitive dynamic where clues come from the verbal language of the text and lead to the memory of similar visual perceptions on the part of the reader.

Even though *The Satanic Verses* is peppered with examples that require a direct experiential link with the perceptual event referred to, one example concerning cinema will suffice for our purposes here. Within the context of the novel, Rushdie is setting up the oppositional stance between the two primary characters, Gibreel Farishta and Saladin Chamcha. In this particular section, the choice of films associated with each serves as a visual indication of the particular world-view each character has adopted:

> he [Gibreel] seemed to wish to make lists: what were Spoono's ten favourite books, he wanted to know; also movies, female film stars, food. Chamcha offered conventional cosmopolitan answers. *Potemkin, Kane, Otto e Mezzo, The Seven Samurai, Alphaville, El Angel Exterminador*. 'You've been brainwashed,' Gibreel scoffed. 'All this Western art-house crap.' His top ten of everything came from 'back home', and was aggressively lowbrow. *Mother India, Mr. India, Shree Charsawbees*: no Ray, no Mrinal Sen, no Aravindan or Ghatak. 'Your head's so full of junk,' he advised Saladin, 'you forgot everything worth knowing.' (p. 439-40).

Typically, an interpretation of this work would stop here and deal with only the interpersonal opposition as representative of the East/West standoff of the novel; however, stopping with the text would mean failing to understand cognitively why it was necessary for Rushdie to choose these details in order to elicit a visually-based response in the reader. These movies are mentioned by name in the text, given a common language tag that cues the act of visual anamnesis in the reader, thus making it necessary to view the mentioning of the film within the greater perceptual context of the writer/reader experience. The films mentioned and the text of the novel exist as definable visual and verbal representatives, but what is more important to our understanding of human cognition is a greater understanding of the cognitive event the writer tries to cue and the reader hopefully tries to enact in order to understand the argument being presented, an argument that uses the text as context for the cinematic events. Figure 1 depicts the relationship between the cinematic background of the writer, the selection of certain cinematic experiences according to the context of the text, reception of the verbal clues through the text, and the assumed cinematic background of the reader.

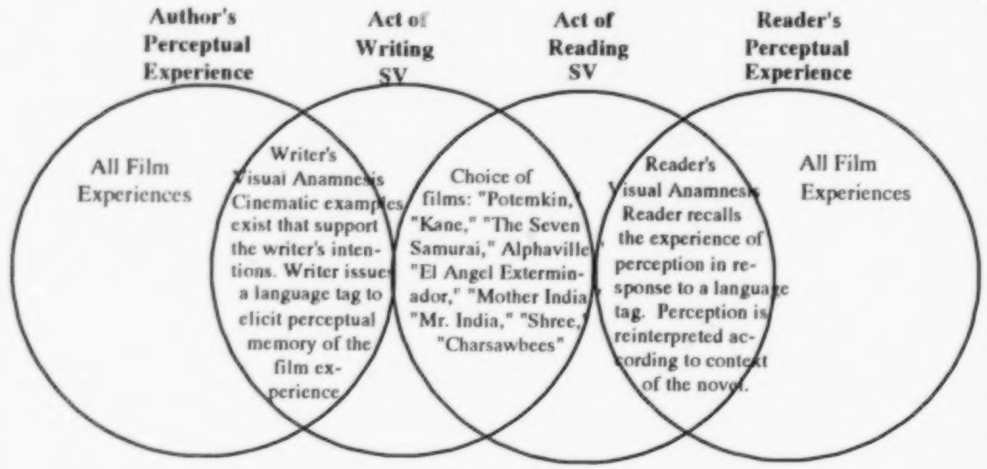
Author's Perceptual Experience
Act of Writing SV
Act of Reading SV
Reader's Perceptual Experience
All Film Experiences
Writer's Visual Anamnesis Cinematic examples exist that support the writer's intentions. Writer issues a language tag to elicit perceptual memory of the film experience
Choice of films: "Potemkin," "Kane," "The Seven Samurai," Alphaville" "El Angel Exterminador," "Mother India" "Mr. India," "Shree," "Charsawbees"
Reader's Visual Anamnesis Reader recalls the experience of perception in response to a language tag. Perception is reinterpreted according to context of the novel.
All Film Experiences

Figure 1

The point to be made here is that viewing the films and understanding them according to the verbal context given is essential to fully discerning Rushdie's meaning. Writing and reading in this light are acts of anamnesis, a recollection, not only of verbal but visual experiences. Even though the uninitiated reader might be able to discern the oppositional stance according to verbal cues, the act of reading here is no more than a realization of what is missing in the form of a visual cinematic experience.

Thus, we come to a crucial point about a primary shortcoming of depending entirely upon the book experience with its reliance on visual anamnesis. What if the perceptual base is not there? Isn't this a rather ideal assumption that the reader will hopefully have experienced enough of the same visual events as the writer in order for full communication to take place? Even though the answer is a resounding yes, it is exactly at this point that pursuing visual/verbal connections through current technologies can rectify an essential problem of the exclusive, narrow book experience. In the form of hypermedia, text elements and visual events can exist simultaneously in a mutually reinforcing and enhancing dynamic. Hypermedia can overcome the artificial separation of the visual and language events; it can join the experiences more closely for the reader, allowing each area to exist with its own integrity, without robbing them of the mutually enhancing synergetic relationship. What is hoped for through anamnesis can be more readily assured through hypermedia opportunities.

Works such as *The Satanic Verses* are readily adaptable to the visual/verbal union in hypermedia form because of the pre-existing hypermedia nature of the author's thinking that is being squeezed into the constrictive book form. With hypermedia, there can exist the circular, associative action that more truly reflects human cognition than the linear book form does, a reflection that would not necessarily be readily available without the visual/verbal/auditory connections that hypermedia allows. Figure 2 represents a conceptual overview of how such a hypermedia application might appear.

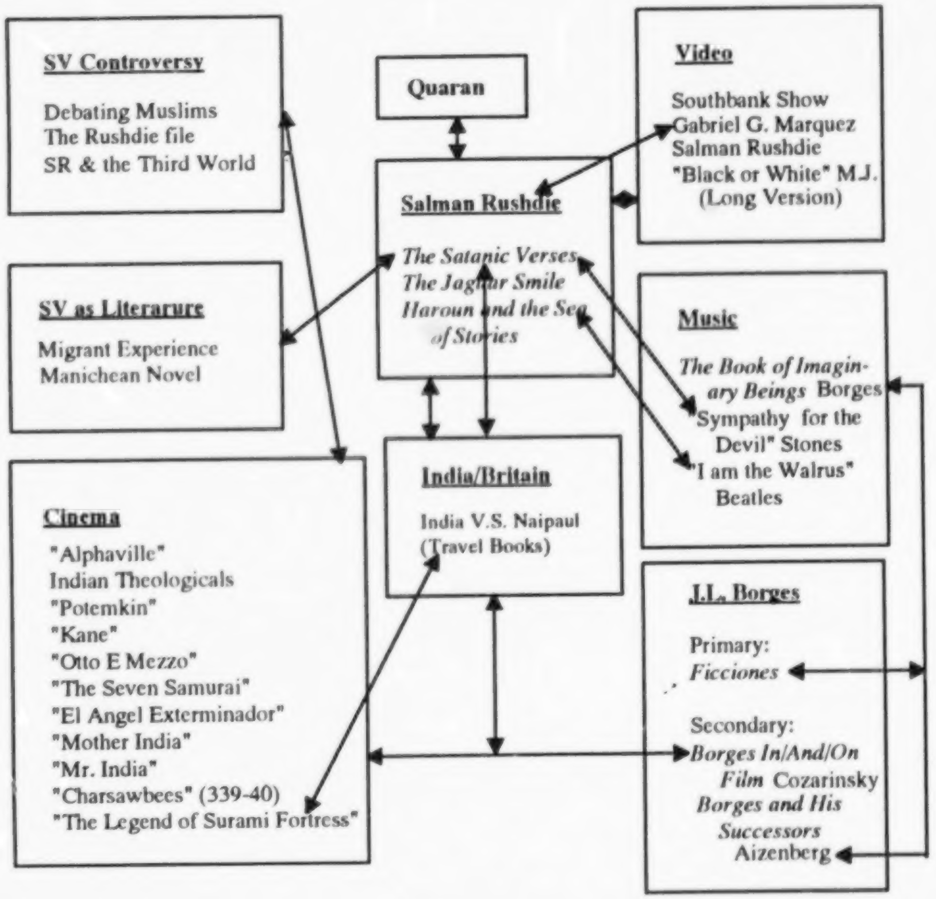
SV Controversy
Debating Muslims
The Rushdie file
SR & the Third World
Quaran
Video
Southbank Show
Gabriel G. Marquez
Salman Rushdie
"Black or White" M.J. (Long Version)
Salman Rushdie
The Satanic Verses
The Jaguar Smile
Haroun and the Sea of Stories
SV as Literarure
Migrant Experience
Manichean Novel
Music
The Book of Imaginary Beings Borges
"Sympathy for the Devil" Stones
"I am the Walrus" Beatles
Cinema
"Alphaville"
Indian Theologicals
"Potemkin"
"Kane"
"Otto E Mezzo"
"The Seven Samurai"
"El Angel Exterminador"
"Mother India"
"Mr. India"
"Charsawbees" (339-40)
"The Legend of Surami Fortress"
India/Britain
India V.S. Naipaul (Travel Books)
J.L. Borges
Primary:
Ficciones
Secondary:
Borges In/And/On Film Cozarinsky
Borges and His Successors Aizenberg

Figure 2

In such a hypermedia application, the traditional "paralyzed constructs" that Arnheim speaks of would no longer be as problematic because visual elements would be made more readily available in conjunction with text. What is more, this availability would allow for the visual experience to be re-entered at will, allowing multiple opportunities for cognitive connections to be made. This associative nature of connections is demonstrated in Figure 3, an associative overview of a hypermedia constellation in the planning stages.

This figure shows how the mental movement is lateral, and at times, this movement may seem impressionistic when,

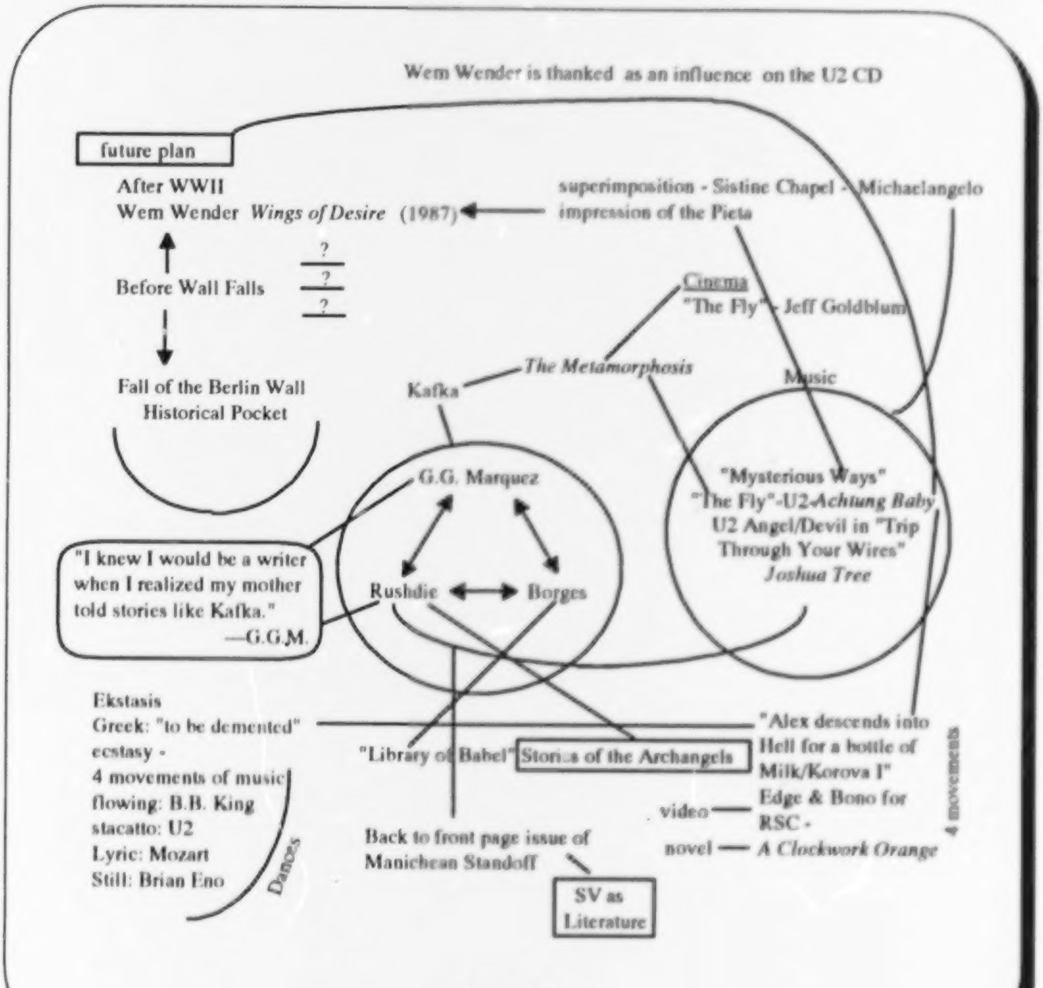
Wem Wender is thanked as an influence on the U2 CD
future plan
After WWII
Wem Wender Wings of Desire (1987)
superimposition - Sistine Chapel - Michaelangelo
impression of the Pieta
?
?
?
Before Wall Falls
Fall of the Berlin Wall
Historical Pocket
Cinema
"The Fly" - Jeff Goldblum
Kafka
The Metamorphosis
Music
G.G. Marquez
Rushdie
Borges
"I knew I would be a writer when I realized my mother told stories like Kafka." —G.G.M.
"Mysterious Ways"
"The Fly"-U2-Achtung Baby
U2 Angel/Devil in "Trip Through Your Wires"
Joshua Tree
Ekstasis
Greek: "to be demented"
ecstasy -
4 movements of music
flowing: B.B. King
stacatto: U2
Lyric: Mozart
Still: Brian Eno
Dances
"Library of Babel"
Stories of the Archangels
Back to front page issue of
Manichean Standoff
SV as Literature
"Alex descends into Hell for a bottle of Milk/Korova I"
video — Edge & Bono for RSC -
novel — A Clockwork Orange
4 movements

Figure 3

in fact, it is not. Portions of perceptual experience, whatever the form, can be assembled in constellations that can seem quite unrelated at first; however, more innovative links can be formed instead of the immediately obvious ones, links made obvious by their resemblance to traditional means of pattern-making within disciplines. What is more, the design of the hypermedia application can solidify these alternative associations without sacrificing the possibility of new ones. Arnheim writes of a similar situation in this example:

> Arrange a number of chips, some white, some black, in a random order, and you will see them loosely related by color without any definite grouping; but let the white chips form a straight line or a circle, and their segregation from the black ones will be immediate and stable. That is, similarity will exert its unifying power only if the structure of the total pattern suggests the necessary relation . . .this means that the cognitive operations inherent in the perception of visual patterns are typically of a much

> higher order than mere connection by resemblance. They require more Perceptual intelligence. (p.55-6)

At first, the hypermedia event might look like a nunber of randomly arranged bits of information, but the perceived relationships enacted by the user can create the straight lines through the constellation, a structure suggested by the "total pattern" of the hypermedia design which will in turn enact the "necessary relation". However, the beauty of hypermedia is that these straight lines can be negotiated at every turn in the constantly shifting relationship *between* these lines.

The book form, divorced from its visual roots, exists as the white chips in a straight line where alternative conceptual structures are chance connections; however, the scrambling effect of hypermedia does not allow such stability to occur and freeze the possibilities of any means of perception. Hypermedia is the step beyond hypertext in that it allows perceptual intelligence to develop more fully and display itself more readily through the coextensive dynamic of assembly and disassembly. Hypermedia, in such applications, finally allows us in reality what writers have pointed to in their fictions, a means of more truly revealing the nature of human cognition based on all our means of perception, a situation in which the separation between the visual and the verbal can no longer comfortably exist.

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